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Marchese Marconi.

GREAT as were Marconi's contributions to the technical side of science, his steady allegiance to the ideal that science is beyond the nations and above the power of creeds to dominate or to stultify was perhaps an even more significant gift to civilization. We look back on his serene beauty of spirit with a poignant regret that its like is becoming rarer in the world of science to-day. To Marconi it was so obvious that knowledge and wisdom are not the prerogatives of any sect, any creed or any nation that he rarely put his instinctive sanity into words. In contrast to those among scientists who insist that the pursuit of science is a form of self-expression and therefore an end in itself, Marconi steadfastly adhered to the view that all scientific work has for its fundamental aim the promotion of human welfare and prosperity. We contribute our testimony to the honour of the great departed scientist.

At the time of his death the Marchese was only 63 years old. He passed away peacefully at 3–30 A.M. on Tuesday, the 20th July. In him the world of science has lost a distinguished investigator and thereby sustained an irreparable loss.

Guglielmo Marconi was born on the 25th of April 1874 at Bologna. His father was an Italian country gentleman while his mother was an Irish lady. He was the younger of two sons and was privately educated at Bologna, Florence and Leghorn. While still a student he was attracted by the researches of Hertz and his ideas were shaped by the work of Righi on the newly discovered electromagnetic waves. He was convinced that this radiation could be used for signalling over long distances, and his life is a brilliant record of the triumph of his faith. Beginning as an unknown inventor, he became the world-renowned father of wireless. His perseverance against great odds in the beginning of his career is a heartening example to the sagging spirits of any investigator, young or old. His first experiments were carried out at his father's country house with very simple apparatus. One simple idea, *viz.*, that of elevating one end of the spark-gap of a Hertzian emitter to form an aerial raised his apparatus immeasurably over those of his predecessors in its radiating power. He substituted a Branley coherer for the spark-gap receiver of Hertz and thus fashioned a much more sensitive detector. His earliest experiments of 1894 and 1895

showed the possibility of wireless communication over the length of a mile and a half. In 1896 Marconi went over to England and receiving the encouragement of Sir William Preece, the Engineer-in-chief to the British Post Office, he was enabled to demonstrate his method to the postal authorities on Salisbury Plain where he succeeded in sending signals over a length of eight miles. The first patent for wireless apparatus was taken out by him on June 2, 1896, and in 1897 "The Wireless Telegraph and Signal Company, Ltd." was formed to develop and exploit his patents. In 1900, the Company's name was changed to "Marconi's Wireless Telegraph Co., Ltd." and continues by that name even to-day. Marconi continued his researches and developed the magnetic detector in 1902 and the horizontal directional aerial in 1905. The range over which communication could be carried out was slowly but surely being widened when in 1901 Marconi astonished the scientific world by achieving what was then thought to be an impossibility.

The theorists of that day thought that there was a very narrow limit to the range which could be covered, on account of the curvature of the earth. They thought that the waves would travel out to space and be lost. Marconi never troubled himself about their theories; he never wavered in his faith. Nature conspired to reward his perseverance and on December 12, 1901, Marconi and his assistants stationed at Newfoundland faintly but surely heard the signals sent across the Atlantic from the powerful station at Poldhu in Cornwall. Once this was accomplished, long distance wireless was securely established and has since then grown apace. The invention of the triode valve in 1913 entirely changed the scope of wireless. From mere signalling, it has since developed into broadcasting of speech and music and the possibilities of television are yet to be explored. In all this advance the Marconi Company has taken a leading share. The disaster of the Titanic in 1912 showed the blessings of Wireless in no mistakable manner. It would now be idle to expatiate on the amenities it has brought into the lives of people all over the world.

In 1916 Marconi came forth with another fundamental discovery, in the course of his attempts to serve the Italian Government during the War. This was the directional effect of short waves and their extraordinary range. It is now a commonplace for amateurs to correspond with one another over more than half the globe with only a power of two or three watts, thanks to this peculiar property of the short waves. Marconi had fitted up his yacht *Elettra* for these investigations and during his voyages first discovered the fact that wireless waves carry farther at night than during the day. He was still engaged in further researches at the time of his death.

The uses to which wireless has been put and can be put during peace and war cannot be enumerated here. But we must not forget that Marconi himself was strongly against the use of scientific inventions for destructive purposes. Although he placed his vast resources and experience at the disposal of the Italian Government during the Abyssinian War, we would still cherish his sentiment that the utilization of scientific genius for the barbarous and horrible purposes of war might ultimately result in the destruction of all that is worth while in our inheritance from the past.

Plenty were the honours Marconi received. He was awarded the Nobel Prize in 1909, the Albert Medal of the Royal Society of Arts, and the Franklin and John Fritz Medals. He was nominated a Member of the Italian Senate and became a Marchese. He represented his country at the Peace Conference in 1919 and later at the Commission on Mandates. The honours showered on him by learned societies are too numerous to mention. In 1905, he married the Hon. Beatrice O'Brien and had one son and two daughters by her. In 1924 this marriage was dissolved, and in 1927 he married the Countess Bezzi-Scali by whom he had a daughter.

As long as his inventions continue to bring solace to troubled humanity, so long will his name be blessed. And if the perverse genius of man utilizes the fruits of his labours for destructive purposes, may we not expect that his spirit will send out an unmistakable reproof?

Stable Dextrins and the Constitution of Starch.

By Karl Myrbäck, *Stockholm.*

TWO fundamentally different theories have been advanced to explain the chemical constitution of starch. One of them considers starch as built up of low-molecular units joined together by forces other than normal valencies to "micelles" the size of which accounts for the conspicuous characteristics of starch.[1] According to the other theory starch is a macromolecular substance in which the units that determine colloidal and other properties are in fact the true molecules.

Some years ago, the first theory was predominant in spite of a pronounced resistance from certain investigators (Staudinger), but to-day it is practically abandoned. It might be said that several of the methods once used to demonstrate the existence of the small fundamental units cannot be regarded as conclusive, and most investigators agree that starch is a true macromolecular substance, the molecules of which are composed of a great number of hexoses united to chains of some sort. A corresponding theory is applicable to cellulose which, as a matter of fact, seems to be less complicated in chemical nature than starch.

The fact that starch may be in different ways rather completely converted into maltose led to the opinion that starch is in principle built up of maltose molecules. Haworth looks upon the starch molecule as a chain of glucose molecules linked together by glucosidic bonds, exclusively.[2] Much evidence is in agreement with this view, nevertheless various experimental results are suggestive of the belief that the molecules of native starch are constituted according to a more complicated scheme. The trimethyl starch, for instance, yields on acid hydrolysis much more tetramethyl glucose than could be expected from the probable molecular weight as calculated on the assumption of simple chains.[3] Further are to be quoted the investigations of Staudinger who has drawn the conclusion that the molecules of starch are branched chains.[4]

It is the author's opinion that the relation of starch to the starch-splitting enzymes is of the greatest importance for the clear understanding of its constitution. The chief product of the enzymatic degradation of starch is invariably maltose. In some cases, maltose might be the only product. It is, however, mostly accompanied by larger or smaller quantities of so-called stable dextrins (limit dextrins) which are not or in any case, only extremely slowly attacked by the enzyme in question. These stable dextrins have a higher molecular weight and a lower reducing power than maltose.

Some fractions or transformation products from native starch yield, when acted upon by certain amylases, nearly 100% of maltose. It might not be unnecessary to emphasise that the very probable presence of maltase in the enzyme preparations must be most carefully taken into account in all determinations of this kind. Among the breakdown products of native starch and soluble starch we have always been able to isolate dextrins, even after prolonged action of the enzyme. Contrary to certain investigators we never found complete decomposition to maltose of, say, potato starch by taka diastase. We could, in fact, always obtain considerable amounts of dextrins having a much higher molecular weight than maltose, although these dextrins as well give perfectly clear watery solutions of low viscosity.

The fact that certain fractions of starch give nearly 100% of maltose, is in the writer's opinion in favour of the idea that the stable dextrins are true residues from the partly decomposed starch molecules. Of course, the possibility must also be considered that the stable dextrins might be secondary products, formed through (perhaps spontaneous) union of primary products of lower molecular weight. This possibility cannot be dismissed without further notice,

[1] Karrer, *Polymere Kohlehydrate*, Leipzig, 1925.

[2] Haworth, *The Constitution of Sugars*, London, 1929.

[3] Haworth, *Chem. Soc.*, 1935, 1201, 1214, 1299; Staudinger and Eilers, *Ber.*, 1936, **69**, 826.

[4] Staudinger and Husemann, *Ann.*, 1937, **527**, 195.

all the more as certain investigators have assumed that even maltose is a secondary product, formed in this way. Many facts are, however, not in accordance with this hypothesis. For instance, it should be anticipated that the quantity and the nature of the dextrins must vary *strongly* with the velocity of the enzyme action. This is, however, not the case. Pringsheim,[5] maintaining the view that dextrins as well as maltose are secondary products, advances the argument, that identical dextrins always are formed by the amylases. This is not correct. Pringsheim seems to assume the existence of only two stable dextrins, di- and tri-hexosans, the former derived from amylose, the latter from amylopectin. Apart from the fact that Pringsheim wholly disregards the phosphorus content of starch and also other similar conditions, it must be emphasised that the stable dextrins always have a molecular weight rather higher than that of the above-mentioned substances. As a matter of fact, no dextrin so far isolated has a molecular weight lower than about 600. Furthermore, the nature of the stable dextrins varies strongly with the type of starch and enzyme used. All dextrins isolated by us also have a distinct reducing power roughly corresponding to one aldehyde group per molecule.

Many facts are in keeping with the view of Staudinger that native starches are composed of a great number of " polymer homologues ". This alone renders it probable that most preparations of stable dextrins accordingly should be mixtures of dextrins differing in molecular weight and other qualities. The action of normal amylases consists, in the author's opinion, in the splitting off of maltose molecules from simple chains of glucose molecules, united by normal α-glucosidic bonds, *i.e.*, from chains possessing the Haworth formula. For instance, I assume that the β-amylase from plant material (ungerminated barley) attacks starch in the following way. Starting from the free ends of the chains or branches of chains the enzyme progressively sets free maltose molecules until it reaches some part of the molecule, differing in structure from the formula of Haworth. Starch is in the main constituted according to this formula, but at certain intervals there are in the chains anomalies of one kind or other. The β-amylase consumes the chains, until such an anomaly puts a stop to its action. (Possibly the action ceases at a certain distance from the anomalies, the length of which depends on the type of the enzyme used.) In my opinion the fundamental difference between amylases is ascribable to the following condition. Some amylases as for instance barley β-amylase attacks starch exclusively from the free ends of the chains whereas others, such as malt amylase and taka diastase, have in addition the capacity of *breaking* the chains between the mentioned anomalies. Such circumstances are, in my opinion, the cause of the striking difference in the action of the so-called β- and α-amylases.

I have been led to this idea through studies on the action of the enzymes on starches of different origin but above all through the investigation of the stable dextrins formed. From what has already been said we are able to draw the very significant conclusion that during the action of the amylases on starch the less interesting parts of the molecules are first split off with the formation of maltose, whereas those details of the molecules diverging in some way from the Haworth formula remain unaltered. Thus, in the stable dextrins, the mentioned anomalies of the starch molecule will appear say 5–10 times more frequently than in the starch itself. Owing to the great mass of " polymaltose " present, an investigation of the native starch may, in many cases, hardly lead to the detection of the anomalies. In a corresponding study of the stable dextrins, however, it is quite conceivable that the " abnormal " structures may be brought to daylight. When converting starch into stable dextrins we concentrate the interesting parts of the starch molecule up to ten times, sometimes possibly more.

The question is now : what anomalies do appear in the starch molecules ?

1. Foreign elements or groups of atoms (non-carbohydrate constituents), above all phosphoric acid, but to a smaller degree also fatty acids and possibly other groupings. Amylases, free from phosphatases and other specific enzymes, do not liberate these foreign groups. A phosphoric acid group in a chain puts an end to the action of the amylase.

[5] Pringsheim, *Polysaccharide*, Berlin, 1931.

It might also be possible, that starch molecules, containing phosphoric acid, are not attacked by certain amylases at all. But in many instances we have been able to isolate stable dextrins of a very low molecular weight, possessing so much phosphoric acid as to justify the conclusion that the phosphorus-containing molecules of starch are, in a large measure, decomposed by the enzyme, leaving the phosphoric acid in the stable dextrins. A rather remote possibility is that the phosphoric acid itself does not prevent the amylase action but that it always appears in connection with some other anomaly in the constitution of the molecule.

2. Sugars other than glucose. Even in stable dextrins having a molecular weight corresponding to only 6 hexose molecules we have not been able to trace any other hexose than glucose.

3. Types of linkages between glucose molecules other than the typical maltose linkage. Two different types are conceivable: (*a*) Each glucose molecule is bound only to one or two others but the carbon atom No. 1 in the first one is linked to a carbon atom other than No. 4 in the second, presumably to Nos. 3 or 6. The chains are simple without branches. (*b*) Certain glucose molecules are attached to more than two others, *i.e.*, the chains are branched. This corresponds to the hypothesis of Staudinger, arrived at through determinations of viscosity. Certain glucose molecules have not only the carbon atoms Nos. 1 and 4 but also Nos. 2 or 3 or 6 or possibly more of them occupied by other glucose molecules.

4. Whether the chains have branches—"side-chains"—or not, it is possible that in certain glucose molecules the oxygen-bridge is differently situated than in normal glucose.

Moreover, it seems highly probable that in starch more of these types of anomalies may occur simultaneously, so that in a preparation of stable dextrin produced enzymatically from a certain starch preparation different molecules may be formed for different reasons. This precludes the possibility that the stable dextrin formed from any native starch might be homogeneous, especially when realising that all native starches and all artificially produced types of starches are themselves non-homogeneous. As a matter of fact, different molecules have not the same size and furthermore the constitutional anomalies are presumably not evenly distributed between all molecules and not situated similarly in different molecules. Accordingly, factors determining the nature of the stable dextrins are among others:

1. The individual magnitude of the starch molecules.
2. The occurrence of non-carbohydrate constituents and the situation of these foreign groups in the chains.
3. Side-chains and situation of their points of attachment.
4. Length of the side-chains.
5. Type of bonds between the glucose molecules in simple chains or at the points of attachment of side-chains.
6. Type of oxygen-bridge in certain glucose molecules.

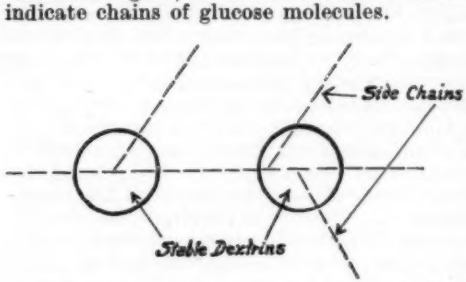
Although all preparations of stable dextrins must be mixtures and all quantitative estimations of their qualities must be considered mean values, it might, of course, be possible to obtain homogeneous preparations by means of careful fractionation, especially when starting from a preparation of starch already fractionated.

When investigating the limit dextrins it is obviously necessary to know their molecular size. For this purpose, we have applied the diffusion method being on various grounds an appropriate procedure. Hitherto, we have studied dextrins, secured from different starches by means of β-amylase from barley, α- + β-amylase from malt, taka diastase and saliva. In contrast to the dextrins produced by the three last-mentioned amylases, the β-dextrins are characterised by a high molecular weight or more adequately by a low diffusion constant. The values obtained with different β-dextrins vary between $k_{20} = 0{,}08 - 0{,}01$. According to Euler's empirical formula, these figures would correspond to molecular weights ranging from 7700 to ca. 500·000. Especially, marked dissimilarities exist between dextrins from different samples of starch. In some strongly degraded starch preparations, *e.g.*, Zulkowski starch, etc., the average molecular weight of the β-dextrins approaches that of the initial starch. It has been found that

approximately 60% of maltose is formed at the same time as the limit dextrin from these starch preparations. This implies that the limit dextrins cannot arise as a result of the formation of 60% of maltose from *all* starch molecules. It is a much more natural assumption that particular molecules yield little if any maltose, whereas others give rise to more than 60% and many of them certainly to almost 100% of maltose.

In contradistinction to β-amylase, malt and taka amylases and saliva, produce from all the starches investigated, limit dextrins having a molecular weight of 600–3000. The difference between preparations obtained from various kinds of starch is not very striking and certainly no relation can be detected to the corresponding differences between the β-dextrins. The molecular weights which, referring to such low-molecular substances, are to be considered fairly reliable (although mean values), preclude naturally the concept of a di- or tri-hexosan nature of the substances; moreover, the possibility must be out of question that the stable dextrins may be in this particular instance unaltered components of the original starch. On the contrary, their formation must obviously be the result of a breakdown of all molecules, some indigestible remnants of the molecules being left. These fragments are identical with the abnormally constituted parts discussed above. Provided the β-amylase yields on the average 60% and, for instance, the β- + α-amylase yield 85% of maltose, the divergence between these enzymes concerning their mode of action upon starch cannot possibly be accounted for on the assumption that malt amylase attacks β-dextrins and splits off an additional number of maltose molecules from a continuous chain. If this be the case, the limit dextrins must evidently have a molecular weight, 35–40% of that of the corresponding β-dextrin. On the contrary, it must be assumed that the β-dextrin when acted upon by malt amylase is decomposed into a rather large number of minor parts, from which a certain amount of maltose is released. This tallies with the above assumption that malt (taka) and salivary amylases have the power of attacking the chains *between* the abnormal parts of the starch molecules.

The estimation of the molecular weight of the limit dextrins must, of course, be accompanied by the determination of their constitution, *i.e.*, chiefly the nature of the glucosidic linkages between the glucose molecules. In this respect, our work proceeds so far along well-known lines. We have concentrated our researches on dextrins having the lowest molecular weight and the lowest P-content obtainable, this being done in the hope that such fractions may not be too unhomogeneous. In fact, much evidence supports our belief that we have succeeded in isolating some rather homogeneous fractions. According to my working hypothesis, the limit dextrins of lowest molecular weight (ca. 600) being practically P-free and containing ca. four glucose molecules represent those parts of the starch molecule, to which the side-chains are attached. *Cf.* the schematic figure, in which the dotted lines indicate chains of glucose molecules.



The first question is: do the four glucose molecules form a normal or a branched chain? (The normal reducing power of the substance precludes the idea of a ring form.) Of course, the methylation method of Haworth should enable us to answer this question quite satisfactorily, although it must be admitted that the procedure is rather laborious. When assuming the above theory to be correct it should be expected that the totally methylated dextrin would yield a much larger quantity of tetramethylglucose than would starch itself.

Doppler Effect in Canal Rays.

By Prof. B. Venkatesachar, *Bangalore.*

EXPERIMENTING with the electric discharge in gases at low pressures, Goldstein[1] first noticed that, when a perforated cathode is employed, streams of violet light passed through the perforations or canals and emerged behind the cathode on the side remote from the anode. Because of the method by which these streams of light were obtained, he called them *Kanalstrahlen* or canal rays. On account of the fact that the rays are normally positively electrified, Sir J. J. Thompson named them 'positive rays'. The simplest type of positive ray is a positively charged atom, which in virtue of its falling through a large potential drop, possesses energy enough to manifest itself. Positive rays are formed from molecules as well as atoms, and any measurement of their mass will yield direct information in regard to the masses of those molecules and atoms. The results of these measurements refer individually to the atoms and molecules and not, as in chemical determinations, to the average value of a large aggregate.

The positive ions which have attained high speeds in the cathode fall of potential pass through the perforations in the cathode, where they gradually lose their speed by impacts with the randomly-moving particles of gas. The principal difference between the canal rays and cathode rays is that the positive ions constituting the former are self-luminous, while the electrons are capable only of causing other substances to radiate. The Doppler effect may be perceived in the light of the canal rays, as first recognised by Stark[2] by a spectroscopic examination. When the light which falls on the slit of the spectroscope is received in the direction of the rays, so that the positive ions are approaching the spectroscope, the spectrum lines are broadened towards the violet, in some cases leaving a dark interval between the normal position of the line and the displaced line. The displacement at any radiation of wave-length λ is given by $d\lambda = \lambda\frac{v}{c}$, where v is the velocity of the positive ions and c the velocity of light. Stark found that all the lines of a given gas were displaced by the same amount and deduced a velocity for the ions of $1{\cdot}2 \times 10^8$ cm. per sec. From the existence of a dark interval between the normal position of the line and the displaced position, it is concluded that the emission of the line spectrum does not begin until a certain velocity of the positive ions is reached. Using a water-cooled hollow cathode[3] about a centimetre long and having an axial slot measuring 1 cm. $\times$ 1 mm., a photograph of the spectrum of the positive rays of hydrogen excited by a D.C. generator of 1 kilowatt capacity exhibits easily the Doppler shift in the Balmer lines. Fig. 1 which is reproduced from a photograph taken by Mr. L. Sibaiya shows the Doppler shift in $H\alpha$, the displaced component being relatively weaker than the undisplaced line.

Hydrogen Positive Rays.—Riezler[4] measured the Doppler effect for homogeneous hydrogen canal rays, and it was found that the velocity calculated from this effect agreed with the velocity deduced from the deflection by an electric or magnetic field. Behind the cathode the charged canal ray particles are actually composed of H^+, H_2^+ and H_3^+. These particles on their further

[1] Goldstein, *Ber. Sits. Ber.*, 1886, 691.

[2] Stark, *Phys. Zeitschr.*, 1905, **6**; 1906, **7**; *Nature*, 1906, **73**.

[3] Venkatesachar and Sibaiya, *Proc. Ind. Acad. Sci.*, 1935, **1**, 955.

[4] Riezler, *Ann. d. Physik.*, 1929, **2**, 429.

path may become neutralised or decomposed and then as neutral hydrogen particles, send out the Balmer lines. Batho and Dempster[5] obtained sharp displaced lines of the Balmer series indicating homogeneous velocities, the displacements agreeing with those calculated from the potential for the H^+, H_2^+ and H_3^+ particles. At lower pressures the displaced line due to H_2^+ was found to become the strongest. Hogness suggested that the double absorption lines observed in some novæ might be of similar origin. Rough measurements of spectra of two novæ gave pairs of velocities approximately as $\sqrt{2}:1$ in each case. Anna McPherson[6] observed an apparent minimum velocity for excitation of radiation in the neutral hydrogen atom at about 40 volts. In the helium-hydrogen mixture the hydrogen Doppler lines due to H_2^+ and H^+ alone were perceptible, that due to H_3^+ not appearing.

Positive Rays of Neon, Argon and Helium.—Romig[7] found that the neon canal ray stream exhibited Doppler effect among the stronger lines in the first and the second spark spectra of neon, the arc spectra almost exhibiting no Doppler shift. The stream consists of rapidly moving neon atoms which radiate only when in the ionised state; hence the radiation from the canal rays is almost entirely from atoms in the ionised condition. Anna McPherson[8] showed that with the exception of λ 3418 of neon, the arc lines of neon and argon have no Doppler shift, while the lines of the first spark spectrum are accompanied by sharp displaced lines only slightly less intense than the rest lines whose separation corresponds accurately to the speeds acquired by singly charged ions in the accelerating field. Experimentally, the ions of hydrogen, argon, neon and helium, formed in a low voltage arc, were accelerated to high speeds in an electric field of high potential gradient forming beams of positive ions which had the same energy. The spectra of the beams of such positive rays observed in the direction of motion showed the characteristic Doppler effect, with the displaced lines fully as sharp as the rest lines. Satisfactory observations were made at a pressure of about 5×10^{-3} mm., the intensity and the sharpness of the displaced lines diminishing with increasing pressure. In helium the arc lines showed relatively faint displaced lines corresponding to singly charged ions; one spark line λ 4686 was accompanied by a relatively intense displaced line, while the only other spark line observed λ 4541 showed no Doppler effect. Further investigation alone can reveal the true nature of these divergent results.

[5] Batho and Dempster, *Astrophys. J.*, 1932, **75**, 34.

[6] Anna McPherson, *Phys. Rev.*, 1934, **45**, 485.

[7] Romig, *ibid.*, 1931, **38**, 1709.

[8] Anna McPherson, *Phys. Rev.*, 1933, **44**, 711.

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It is gratifying to note that Governments and Universities which foster and promote learning are appreciating the services of *Current Science*; and by their handsome support they have placed the *Journal* in a position to render further service in the promotion and diffusion of scientific knowledge.

LETTERS TO THE EDITOR.

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Diamagnetism of Mercury.

Mercury occupies a unique position among the metals. It forms several amalgams with various elements. Some magnetic work on the copper amalgams has been referred to from this laboratory (Physical Principles of Magneto-Chemistry by Bhatnagar and K. N. Mathur). From the results it would appear that the mixture law is valid as long as the amalgam is very dilute and remains liquid. On solidification due to the higher concentration of copper its diamagnetism decreases and the mixture law is no more applicable. This has recently been confirmed by Bates and Tai.[1] However, it was not then found desirable to give particular attention to the specific diamagnetic value of mercury as the results concerned were only of a comparative nature. The specific diamagnetic values of mercury obtained by various authors are not consistent. In 1910, Honda and Owen[2] gave a value 0·19 for $-\chi \cdot 10^6$ which was further corrected to 0·184 by Owen[3] in 1912 from Kahlbaum's sample of 0·0002% impurity of iron. From the examination of some mercury amalgams, Davis and Keeping[4] got the specific diamagnetic value 0·189 for mercury. In an investigation of dia- and para-magnetism in series of metallic mixed crystals, E. Vogt[5] has found the diamagnetic susceptibility of mercury to be $-0{\cdot}168 \times 10^{-6}$. He has, however, made no mention of the purity of mercury employed by him. In a recent publication Bates and Tai[6] have reported that mercury has a diamagnetic susceptibility $-0{\cdot}1676 \times 10^{-6}$ and this value is in substantial agreement with that of Vogt.

J. S. Shur[7] has recently given the specific diamagnetic value 0·389 for mercury in the vapour state. The value 0·389 obtained by him approximately corresponds to 0·419 calculated theoretically by Slater's method, while all the values in the liquid state are decidedly low. It has been deduced from an examination of the various physical properties of mercury that it is monoatomic in the vapour state and polyatomic in the liquid state. The fact that the diamagnetic susceptibility in the vapour state is quite different from that in the liquid state clearly establishes the above statement from the magnetic point of view. Further, there is so great a discord between the different diamagnetic specific values of mercury that it was found desirable to investigate mercury that can be obtained in the utmost purified condition. The inconsistency in the various values

may be attributed to the different impurities such as iron and zinc which can only be removed with great difficulty. Special care must therefore be taken to purify mercury. It is always better to get it from one of its chemical compounds which can be obtained in a higher state of purity. In the present investigation mercury was obtained from Kahlbaum's extra pure compounds of mercury. All the necessary precautions were taken to get it in as pure a condition as possible.

Specific and Atomic Susceptibilities of Mercury. Experimental Values.

Authors	Specific susceptibility $-\chi \cdot 10^6$	Atomic susceptibility $-\chi_{at} \cdot 10^6$
Honda and Owen ..	0·19	38·1
Owen	0·184	36·9
Davis and Keeping ..	0·189	37·9
E. Vogt	0·168	33·7
Bates and Tai ..	0·1676	33·6
Present Authors' Observation.		
1. Purified and distilled ..	0·157	31·5
2. Obtained from extra pure oxide of mercury ..	0·1716	34·4
3. Obtained from extra pure mercuric nitrate ..	0·1729	34·7
4. Obtained from extra pure mercuric benzoate ..	0·172	34·5
J. S. Shur ..	0·389	78·0 vapour
Theoretical Value.		
Calculated according to Slater's method..	0·42	84·6

The specific and atomic susceptibilities of purified and distilled mercury are rather low when compared with other experimental values. The values obtained from Kahlbaum's extra pure compounds are, however, almost the same as obtained by E. Vogt, Bates and Tai. The higher specific and atomic susceptibilities obtained by Shur in the vapour state and their close resemblance with the theoretically calculated values by Slater's method, show that mercury is monoatomic in the vapour state. The lower diamagnetic values of mercury in the liquid state may be attributed to the polyatomic molecule of mercury. This can further be explained on the assumption that the free electrons in the outer orbit of mercury may be interchanging between the component atoms to form an aggregate of complex or polyatomic mercury. It is rather curious to note that the atomic diamagnetic values in the liquid state closely correspond to the susceptibility constants of mercury in the divalent and extremely covalent state. Considering the interesting work so far accomplished and the fact that many important conclusions are derived from it, it appears desirable to investigate mercury in a spectroscopically pure state also. Further work will be reported on this subject shortly.

S. S. Bhatnagar.
M. B. Nevgi.

University Chemical Laboratories,
Lahore,
August 5, 1937.

[1] Bates and Tai, *Proc. Phys. Soc.*, 1936, **48**, 795.
[2] Honda and Owen, *Ann. Phys. Lpz.*, 1910, **32**, 1027.
[3] Owen, *ibid.*, 1912, **37**, 657.
[4] Davis and Keeping, *Phil. Mag.*, 1929, **7**, 145.
[5] E. Vogt, *Ann. Phys. Lpz.*, 1932, **1**, 14.
[6] Bates and Tai, *loc. cit.* under 1.
[7] J. S. Shur, *Nature*, May 8, 1937.

The Diamagnetic Susceptibility of Some Complex Ions.

Several investigators have determined the diamagnetic susceptibilities of simple and complex ions.[1] The experimental values have been compared favourably with the theoretical estimates made by Pauling, Stoner, Slater and Angus.[1] Most of the magnetic measurements have been made with the substances in the solid state. The influence of the deforming power of ions on each other when they combine to form compounds does not seem to have been taken into account in the estimation of ionic susceptibilities. This aspect has been considered at some length by Varadachari[2] and Subramaniam[1] from this laboratory. One method of studying ionic deformation which

follows from their experimental work is to study the susceptibilities of salts in the solid and dissolved states. The predominant factor in the change of susceptibility on solution is ordinarily the release of ionic deformations.

From these points of view, a study has been made of the susceptibilities of some formates and acetates, nitrites and nitrates, iodates and selenites in the state of solid and in solutions in water. Formates and acetates show very small changes of susceptibility when dissolved in water. Investigations with iodic acid and iodates show that the specific diamagnetic susceptibility is greater in the solid state than in the state of solution. On comparing these results with Raman effect data obtained by Venkateswaran,[3] it looks most likely that the observed changes should be due to dissociation of iodic acid and iodate molecules in water but the matter seems to require further investigation. Nitrates show small changes in susceptibility when dissolved in water while nitrites show a comparatively large increase. Magnetic data support the view that the nitrogen in the nitrite ion is trivalent. In the case of selenites, the diamagnetic susceptibility increases when they are dissolved in water. This result supports quantitatively Venkateswaran's[4] inference that in the solid selenious acid, selenium is hexavalent while in aqueous solutions, it becomes tetravalent.

The following table gives the values of the ionic susceptibilities obtained from a careful study of over 16 salts in the solid and dissolved states:—

Ion	Ionic diamagnetic susceptibility.		
	Calculated from solid data	Calculated from solution data	Kido[5]
$(COOH)^-$	17·3	17·6	20·2
$(CH_3COOH)^-$	29·8	30·2	31·4
$(IO_3)^-$	47·3	41·1	52·2
$(NO_2)^-$	8·0	11·4	15·0
$(NO_3)^-$	18·1	19·5	20·1
$(SeO_3)^{--}$	44·9	52·7	47·5

These considerations point to the necessity of studying salts in aqueous solutions before definite inferences could be drawn regarding the susceptibilities of the ions concerned. Full details will be published elsewhere.

S. Ramachandra Rao.
S. Sriraman.

Annamalai University,
Annamalainagar,
August 8, 1937.

[1] These references are given in Subramaniam, *Proc. Ind. Acad. Sci.*, **1936, 4,** 404.
[2] *Ibid.*, **1935, 2,** 161.
[3] *Ibid.*, **1935, 2,** 119.
[4] *Ibid.*, **1936, 3,** 533.
[5] *Sci. Rep. Tohoku Imp. Univ.*, **1933, 22,** 835.

Dispersion of Sound Velocity in Liquids.

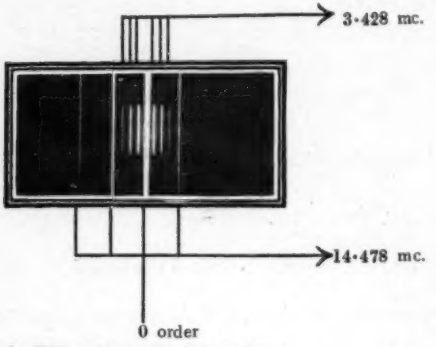
The question of dispersion of sound velocity in liquids has assumed great importance in view of recent reports by several physicists,[1] of high absorption of sound in liquids at ultrasonic frequencies. But the experimental results[2] so far obtained are indecisive, and it is obvious, therefore, that an arrangement should be sought for, wherein errors likely to alter the velocity ever so little, are completely eliminated, before one could be certain of any dispersion.

An oscillator set was constructed with two sets of coil and condenser to give roughly 3·5 and 14·5 megacycles independently of each other and with only by a change of switches. But the circuit connecting the piezo-quartz was the same in both the cases, so that the crystal once immersed in a liquid was left undisturbed throughout the entire operation of obtaining the spectra at the two frequencies. In this method, the arrangement including the optical system was not altered, thereby eliminating all errors incidental to such disturbances.

The two diffraction spectra were taken on the same photographic plate; no error arises on account of the measurement of the distance between the fringes. The temperature of the liquid was measured accurately to one-tenth of a degree Centigrade before and after each experiment, and no fluctuation in temperature by even the above amount was noticed. The lower and higher frequencies were determined

accurately in each case by a precision wave-meter.

The accompanying photograph shows the diffraction spectra at 3·428 mc. and 14·478 mc. taken with toluene as the liquid.



Diffraction spectra in toluene.

Experiments were carried out with the above arrangement on six liquids. While toluene and *m*-xylene show no dispersion within the range investigated, benzene, carbon tetrachloride and tetralin show a definite increase in velocity at 14·5 mc. and amyl-acetate a decrease in velocity.

The following table gives the experimental results :—

Liquids	Temp. in °C.	Sound velocity in m./s.	
		at 3·5 mc.	at 14·5 mc.
1. Benzene ..	26·8	1284	1290
2. Toluene ..	30·9	1272	1272
3. *m*-Xylene ..	27·1	1302	1302
4. Tetralin ..	30·3	1430	1434
5. Carbon tetrachloride ..	27·6	907·4	912·4
6. Amyl-acetate ..	27·2	1190	1179

A detailed paper will be published elsewhere.

S. PARTHASARATHY.
Indian Institute of Science,
Bangalore,
July 15, 1937.

[1] P. Biquard, *Thesis*, Paris, 1935.
R. Lucas and P. Biquard, *Trans. Farad. Soc.*, 1937, **33**, 130.
J. Clæys, J. Errera and H. Sack, *ibid.*, 1937, **33**, 136.
C. Sörensen, *Ann. Physik.*, 1936, **26**, 121.
[2] E. Hiedemann, N. Seifen, and E. Schreuer, *Naturwissen.*, 1936, **24**, 681.
S. Parthasarathy, *Proc. Ind. Acad. Sci.*, 1936, **4**, 17.

The Condensation of Resacetophenone with Open-chain and Cyclic β-ketonic Esters.

RESACETOPHENONE condenses with ethyl-acetoacetate in the presence of phosphorus oxychloride with the formation of 4-methyl-6-acetyl-7-hydroxycoumarin, (50% yield), which has already been isolated (in a small yield) by Limaye and Gangal[1] from the Frie's migration product of 7-acetoxy-4-methylcoumarin. The condensation does not take place in the presence of either concentrated sulphuric acid or sodium ethoxide. The reaction can be applied to all the unsubstituted and mono-substituted open-chain, as well as, cyclic β-ketonic esters, and we have already obtained a number of this type of coumarins and studied their properties. Full details will be shortly submitted for publication in the *Proceedings of the Indian Academy of Sciences.*

R. D. DESAI.
SHEIK ABDUL HAMID.
Muslim University,
Aligarh,
July 8, 1937.

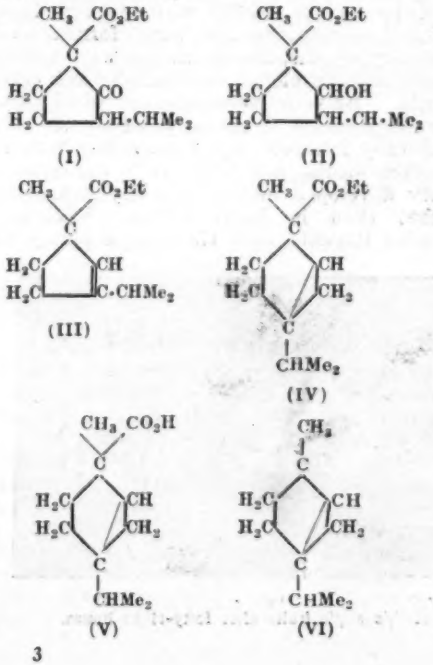
[1] *Rasayanam*, 1936, **1**, 15.

Synthesis of Thujane.

THE synthesis of thujane, the parent hydrocarbon of the naturally occurring bicyclic terpenes of this group, was undertaken simultaneously in this laboratory by two different methods: *viz.*, (i) starting from a *cyclo*hexane derivative having two bromine atoms in positions 2 and 4, a methyl group in position 1, and an isopropyl group in position 4, and (ii) from a *cyclo*pentene derivative possessing a methyl group in position 1, a double bond between the carbon atoms in positions 2 and 3, and an *iso*propyl

group in position 3. Our first scheme resulted in the synthesis of thujane starting from menthol.[1]

In the present communication, we are going to describe the synthesis of thujane according to our second scheme starting from ethyl 1-methyl-3-isopropyl*cyclo*pentane-2-one-1-carboxylate (I). This compound was prepared according to the method of Kotz and Schuler[2] starting from diethyl adipate. Compound (I), b.p. 133°/12 mm., was reduced with sodium amalgam to the corresponding secondary alcohol (II), b.p. 153–56°/11 mm. (phenyl urethane derivative, m.p. 144–45°) which in its turn was converted into the *cyclo*pentene derivative (III, (b.p. 114–15°/11 mm.) by the action of phosphorus pentoxide in benzene solution. The unsaturated compound (III) reacts with diazomethane on being allowed to stand in ethereal solution at 0° during two weeks to yield the bi*cyclo*-0 : 1 : 3-hexane derivative (IV, b.p. 130–32°/12 mm.) giving on hydrolysis with 5 per cent. KOH the corresponding croboxylic acid (V), m.p. 93–94° ; Eq. Wt. found 180·9 ; required 182. The acid on being distilled with soda lime under reduced pressure gives thujane (VI), b.p. 155–56° ;



n_D, 1·4400 ; d_{26}^{28}, 0·8143, the corresponding values of thujane as given by Semmler and Feldstein[3] being b.p. 156–57° ; d_{21}^{22}, 0·8158 ; n_D, 1·44121.

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Department of Organic Chemistry,
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Bangalore,
July 31, 1937.

[1] *Ber.*, 1937, **70**, 931.
[2] *Annalen*, 1906, **350**, 226.
[3] *Ber.*, 1914, **47**, 387.

Occurrence of Rotenone in *Millettia pachycarpa*.

The importance of rotenone as an insecticide is now well established and the demand for rotenone-bearing plants is daily increasing. In a previous communication[1] we had reported the discovery of the rotenone-bearing *Derris elliptica* in India. Since then we have continued our exploratory work on other fish poison plants and we are now able to report the presence of rotenone in *Millettia pachycarpa* (N. O. Leguminosæ).

These samples of roots were obtained from two different localities, Kalimpong and Gauhati and from both of these we have isolated 4% total resins and 1·2% of pure crystallised rotenone. Presence of one per cent. rotenone in *Millettia* does not, however, make it an important source of the insecticide but, in view of the fact that the plants investigated were wild and of very uncertain age, the results are encouraging and lead to the hope that on cultivation and proper harvesting the amount of the insecticide might increase. Furthermore, the interest in this finding lies in the fact, that some of the *Millettia* species are pests in some of our forests and a systematic investigation might lead to an economic use being found for them.

T. P. Ghose.
S. Krishna.

Forest Research Institute,
Dehra Dun,
July 8, 1937.

[1] *Curr. Sci.*, 1936, **4**, 857.

A Fruit Rot of Apples Caused by a Species of *Rhizopus*.

In the course of investigations on the 'codling moth,' the Imperial Entomologist received apples from Quetta which were affected by a soft-rot due to fungal infection. Such samples were sent to the Mycological Section for examination and report throughout the months of June and July. The rotting fruits were soft but firm and in the earlier stages did not show any 'leak'. The skin was "russet" to "verona brown" in colour (Ridgway's) and could be easily peeled away from the underlying tissue. The fruit had a slightly sour but not an unpleasant odour and was easy to cut across, for, the core hardly offered any resistance. The pulp was "zinc orange" and the scales, within which the seeds were enclosed, easily detached themselves from the tissue of the core. On the surface of the fruit no fungal growth was perceptible but the seeds were covered with a weft of mycelium studded with black bodies. In certain cases the seed was absent but the cavity was occupied by a thin mycelial pad. Whenever the skin was removed or the fruit cut open, whitish aerial mycelium appeared on the surface within twenty-four hours.

Microscopic examination of the diseased tissues showed the presence of broad, coarse, aseptate, light brown hyphæ following a tortuous course probably due to their being inter-cellular. These main hyphæ produced narrower lateral branches of variable length which usually penetrated the host cells and sometimes the inter-cellular spaces also. The host cells abutting on the hyphæ were darker brown than those farther away and the hyphæ could therefore be easily traced. There was no "killing in advance" in the green apples; the rotting was closely associated with the hyphæ. The mycelium enveloping the seed was broad, coarse, aseptate more or less hyaline and rhizoids were rare.

Tissue cultures in most isolations yielded pure cultures of a fungus which was identified as a species of *Rhizopus*. The sporangiophores of the fungus formed within the cavity containing the seeds were usually borne on bulbous, brownish swellings or were the terminations of ordinary hyphæ. On the bulbous swellings one to many sporangiophores were produced in the manner figured for *Rhizopus arrhizus* Fischer by Zycha[1] and for *R. nodosus* Namys. by Lendner.[2] These sporangiophores measured usually 160 to 480 μ in length. The sporangia were more or less globose and 80 to 176 μ, mostly 100 to 112 μ, in diameter. The spores were slightly angular, faintly striated, irregular in size and 5 to 7·2 μ in diameter. Hyaline chlamydospores were sometimes noted.

The fungus produced light brownish rhizoids on culture media (though sparsely), and hyaline or faintly pigmented stolons. When sporangiophores were formed on ordinary hyphæ, the sporangia were rather small and developed a hemispherical columella. Bulbous swellings on which the sporangiophores frequently arose on the naturally infected fruit were rather rare in culture media, but when they did appear they developed more frequently in culture tubes than in Petri dishes. Tentative studies indicate that the fungus can grow

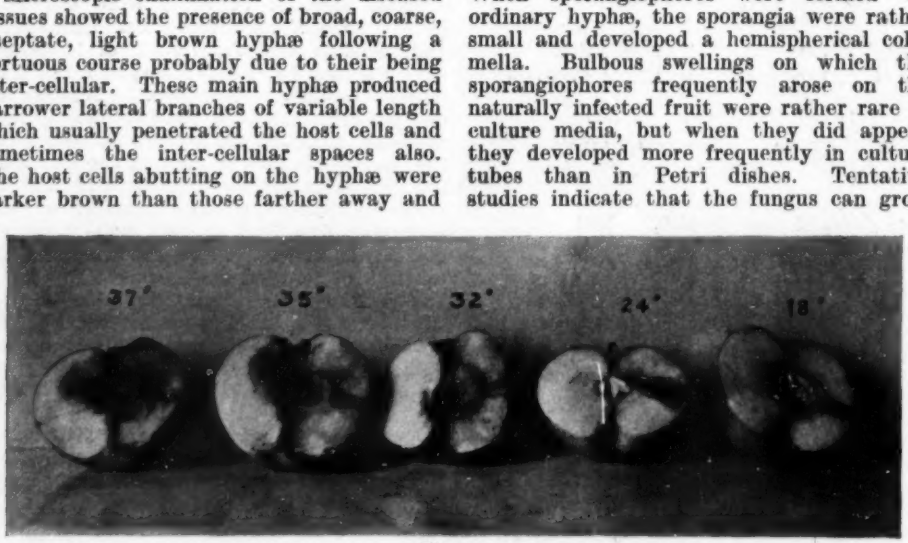

Fig. 1.

Showing the effect of temperature on the rotting of ripe apple fruits after forty-eight hours.

from 10° to 40° C., sporangial formation taking place at any temperature from 15° to 40° C. Best growth of the fungus appeared to be at 37° C. Chlamydospores developed on the stolons and on the ordinary hyphæ.

A majority of the rotten apples that had been received were green or partially mature fruit and artificial infections were therefore made on both the green partially mature, and ripe fruits. Slight wounding was necessary to start infection. Rotting was slow from 15° to 23° C. but between the temperatures of 32° to 38° C., very rapid decay took place (Fig. 1). The 'well' method of infection gave more uniform results. The rot extended within as rapidly as it increased on the surface and examination of artificially infected and completely decayed fruit showed that the fungus had enveloped the seed with a weft of mycelium just as in a naturally infected fruit. Both the ripe and the green fruit were equally susceptible.

The fungus falls within the 'arrhizus group' of Yamamoto[3] and fits *R. arrhizus* of Zycha.[1] It is hoped to correctly establish its identity after a careful comparison with authentic cultures of some of these fungi. *R. nigricans* Ehrenberg has been known to cause apple rots in countries with temperate climates and parasitic potentialities of the species of 'arrhizus group' which grow better at higher temperatures are well known and their parasitism on apples, other fruits and vegetables has also been established by Harter and Weimer.[4]

So far only one other fungus, *Aspergillus niger* Van Tieghem, has been reported to cause rot in apples by Dey[5] but rot due to a species of *Rhizopus* has not been yet reported.

I am grateful to Dr. B. B. Mundkur for advice and helpful suggestions.

P. R. Mehta.

Imperial Agricultural Research Institute, New Delhi, *August* 12, 1937.

[1] Zycha, H., *Kryptogamenflora der Mark Brandenburg*, 1935, Band, **6**(*a*).

[2] Lendner, A., *Les Mucorinees de la Suisse.*

[3] Yamamoto, Y., *Jour. Fac. Agric. Hokkaido, Imper. Univ. Sapporo, Japan*, 1930, **1**, 1–101.

[4] Harter, L. L., and Weimer, J. L., *Phytopathology*, 1922, **12**, 205–212.

[5] Dey, P. K., *Ind. jour. Agric. Sci.*, 1933, **3**, 663–673.

An Amphibious Parasite from Lac.

In their reply to the controversy upon the hosts of *Eupelmus tachardiæ*, How. Negi, Glover and Gupta[1] illustrate a "just hatched larva", (Fig. 1 *c*), which hardly shows any hymenopterous characters, much less those specific to *Eupelmus tachardiæ*. With regard to Fig. 1 *d* they confess "details are not fully shown", although the larva is supposed to be full grown. It is very modest of them to say so, for I find not a single character distinguishing it from that of Elasmus or of Microbracon; even the magnification is not indicated. (Fig. 1 *e*) should represent a prepupa and I have not come across the prepupal stage of any chalcid I have studied. On the contrary their figure shows typical pupal characters, so that they are not able to interpret even what they illustrate. In Fig. 1 *e*, the pupa then, and not the prepupa, is partly visible and partly hidden by the

Fig. 1.

Pupa of a female *Eupelmus tachardiæ*, How.

larval skin, whereby, not only light, but also, distinct shadow has been cast upon an object of controversy which should have appeared in full limelight. What is exhibited of the pupa is common to many chalcids and the small abdomen is distinctly unlike that of Eupelmus which I have already shown[2] and is again illustrated here. Their Fig. 1 *a*, should have represented the cocoon of Microbracon, which I here illustrate for comparison and not any cocoon; likewise the larva looks neither paralysed nor that of *Microbracon greeni*. I find no specific character which could identify the objects they illustrate.

My previous illustration[2] shows the anal end with a curved ovipositor characteristic of the female Eupelmus. To indicate how true to life this representation has been I offer in, Fig. 1, a photograph showing a similar specimen. The moult skin is also seen which hides nothing of the pupa from view. It was obtained as an ectoparasite on the larva of *Eublemma amabilis*, contrary to the expectations of Negi and Glover. To get such a specimen, with the larval skin still in contact with the pupal body, from within the lac cell or even from within the cocoon of a Microbracon, would not have been possible unless the existence of an Eupelmus pupa within were known and precautions were taken to avoid the otherwise easy separation of the moult skin and the pupa. My previous illustration and Fig. 1 here are both accompanied with a scale which indicates the pupa to be a little less than 2·5 mm. Fig. 2 shows another pupa on its back; Fig. 3 gives the dorsal aspect of another specimen with the attached moult skin at the anal end.

Glover and Negi most innocently evade the point to which I took the greatest objection,[3] *viz.*, "Glover makes the glaring statement of having found *Eupelmus tachardiæ* inimical to lac itself," an objection which has been independently raised by Clausen[4] in America. I find all endoparasites of lac have two life-cycles to one of the host, passing one in the larval and the other in the adult lac insect. In the larval lac insect there is only a single parasite, a fact also apparent from an illustration of Imms and Chatterjee.[6] As previously explained,[5] the female lac insect in the second larval stage is relatively

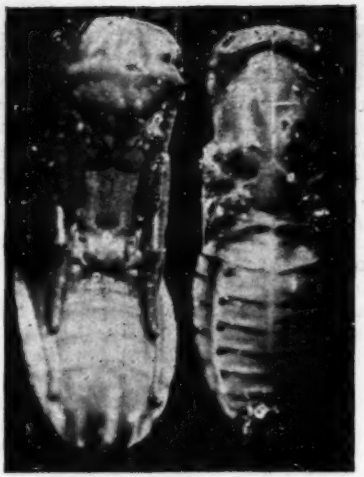

Fig. 2. **Fig. 3.**

FIG. 2.—Female *Eupelmus tachardiæ* pupa in its ventral aspect.

FIG. 3.—Dorsal view of a female *Eupelmus tachardiæ* pupa.

raised and oval in outline, the corresponding cell of the male lac insect, on the contrary, is flatter and longer. The latter when parasitised and containing the cylindrical body of a chalcid pupa also becomes raised and oval. The parasitised male larval cell is therefore a better specimen to demonstrate than the corresponding female cell which is already oval. Now the species, *Lakshadia communis*, very often gives rise to a generation consisting of only winged males. In such a generation the sex of the larva can be identified with certainty. Fig. 4 shows a second stage larva of a winged male *Lakshadia communis*, containing a single pupa of *Erencyrtus dewitzii* as was found on dissection after the specimen was photographed. To me it appears improbable that the pupa of Eupelmus, which is about 2·5 mm. long, can thus live within the small lac cell and such a consideration excludes the possibility of Eupelmus being an endoparasite of lac.

Observations were made upon the exit holes caused by various parasites in lac encrustation in different stages of its development. Fig. 5 gives a picture of

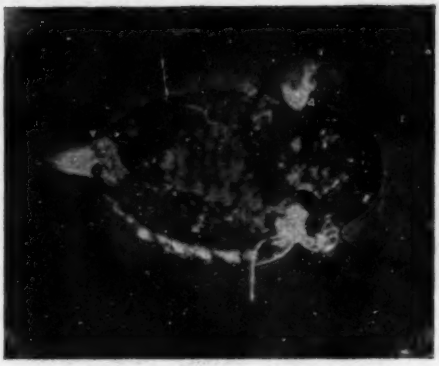

Fig. 4.

Second stage larval cell of a winged male lac insect which contained the pupa of a chalcid.

Background slightly retouched to show the cell outline.

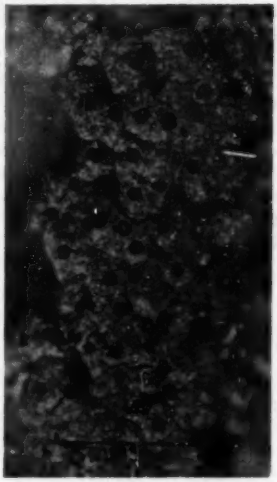

Fig. 5.

Exit holes in the cells of *Lakshadia communis* females in the larval stage attacked by *Erencyrtus dewitzii*.

larval cells of *Lakshadia communis* comprising mostly of female larvæ attacked solely by *Erencyrtus dewitzii*; it will be apparent that practically every cell has been attacked. A scale is given to exactly indicate the size of the apertures which correspond with the size of the heads possessed by the male and female Erencyrtus adults. All endoparasites of lac are more or less alike in size and a study of such exit holes does not give a clue to the identification of the parasites which have emerged through them. But Eupelmus is nearly more than twice the size of any endoparasitic chalcid and the apertures made by it, if any, should appear at least twice as large as those seen in Fig. 5 here. Care should however be taken not to confuse the exit holes made by predacious caterpillars of moths and this can be done by finding a case where the infection is almost **total and pure** as represented by me in Fig. 5. From such indefatigable workers as Negi and colleagues, who keep on reasserting their statements, it is hoped such evidence could be most easily furnished. In Fig. 5 a white line points to a dead female lac cell in the first larval stage. As previously shown[5] such an object measures about 1 mm. so that its presence also indicates the diameter of the exit holes as 0·5 mm. in Fig. 5. The photograph with such fine details speaks for its quality and any critic can convince himself, with the help of a magnifying glass, that the exit holes were not made with the help of a pin.

The adult stage of a lac insect has rarely only one chalcid, in which case the host insect does not die. Usually, or rather invariably, there are at least three of them while in cells, such as are seen in Fig. 6, there are over five individuals; two larvæ are pointed with P. It seems

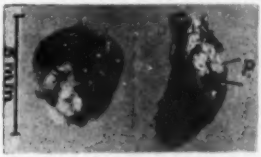

Fig. 6.

Lakshadia mysorensis, adults containing larvæ of a a chalcid parasite P.

to me improbable to find a lac insect which survived after the attack of a single Eupelmus or to find a dead lac insect with three of its pupæ; I speak of pupæ for they, and not their larvæ, are most easy to identify.

Fig. 7 shows nine cocoons of Bracons with a scale to indicate the magnification. The largest of them all, the cocoon to the right, belongs to *Aphrostrobracon flavipennis*, first[7] observed in India by me and was found attacking *Eublemma amabilis*. The

Fig. 7.

Cocoons of *Microbracon greeni*, eight smaller ones, with exit holes due to the emergence of Bracons and with smaller holes made by an unknown chalcid.

The large cocoon to the right belongs to *Aphrostobracon flavipennis* with an exit hole.

remaining eight cocoons belong to *Microbracon greeni*, also feeding on the same caterpillars. These cocoons show apertures which are not uniform in diameter and I suspected a chalcid to be responsible for the smaller holes. In fact I already announced the existence of an enemy of Microbracon. Originally, I imagined it to be a Dibrachys[8] species which both Prof. Masi and Dr. Gahan kindly identified as *Aplatomorpha calandræ*, How., known to attack grain-feeding beetles like *Calandra granaria*.[9] There are several beetles associated with lac and as such it could be assumed to destroy some of them. But I have made many observations on *Aplatomorpha calandræ* in the lac plantations as well as on lac grown experimentally, where I found it hovering about on young encrustations which, I convinced myself, had had no larvæ of predacious beetles but which nevertheless had those of Eublemma and with its presence that of Microbracon could also be assumed. My observations were not concluded and I published nothing more upon it before. But I have frequently come across it and its absence from the records of Glover and Negi is surprising. It seems to me possible that they have mistaken this insect and Eupelmus for one and the same species. For a number of years they have been naively designating their parasites as, "Black Chalcid No. 2," etc.,[10] and since both Eupelmus and Aplatomorpha are black and large there may have arisen a natural confusion. That they thought it necessary to send even their largest chalcid to others for identification, not for confirmation of their own identification, shows the deep familiarity with the insect they have been studying. What was pertinent to know was, not who identified their adults about which they inform us nothing, but who identified the pupæ one of which they so sophistically illuminate.

Glover and Negi suggest trying to breed Eupelmus under laboratory conditions and I have already come across the phenomenon of induced parasiticism. Field experiments are certainly preferable and these have given me definite information which was supported by the findings of Gernet[11] in 1863. He found Eublemma, the host, with Eupelmus, the parasite. Gernet also found the male Eupelmus which indicates in his specimen of lac there must have been many Eupelmus insects for the ratio between the sexes in this insect is very much in favour of the female. The absence of Gernet finding any Braconid indicates the probability of Microbracon not serving as a host of Eupelmus. Gernet also found endoparasites of lac and illustrated a pupa of *Tachardiæphagus*, of which there could only be the species *tachardiæ* (How.). An internal parasite of lac was first figured as early as 1790 by Roxburg and ever since the findings of Green, Stebbing and Imms and Chatterjee have never brought out any instance where Eupelmus was an endoparasite. These offer circumstantial evidence in support of my view to which Clausen's objection must also be counted. To skip over it all and maintain nevertheless that they discovered a prodigy among chalcids which has five different hosts and acts as an ecto- and endo-parasite is to assume the existence of an amphibious creature the like of which is so far unknown to entomologists.

S. MAHDIHASSAN.

Berlin,
June 28, 1937.

[1] *Curr. Sci.*, 1935, **4**, 37.
[2] *Curr. Sci.*, 1935, **3**, 562.

[3] *Ibid.*, 1934, **3**, 260.
[4] *Ann. Ent. Soc. Amer.*, 1927, **20**, 470.
[5] *J. Ind. Inst. Sc.*, 1926, **9A**, Pt. 1.
[6] *Ind. Forest Mem.*, 1915, **3**, Pt. 1, Fig. 34.
[7] *J. Sc. Assoc. Vizianagram*, 1925, **2**, 79.
[8] *Ibid.*, 1925, **2**, 88.
[9] *Report of the Grain Pest (War) Committee*, No. 9 pub. by the Royal Society, 1921.
[10] *Rep. Ind. Lac Res. Inst., Ranchi*, 1930, p. 49; 1928, p. 26.
[11] *Bull. Soc. imp. des nat. de Moscou*, 1863, 154–74.

Sulphur Iodide.

THE existence of sulphur iodide has been a matter of controversy. Investigations carried out in this laboratory show that sulphur iodide is formed in carbon tetrachloride solution when a dilute solution of sulphur chloride is treated with solid potassium iodide. Sulphur iodide in dilute solutions in carbon tetrachloride has a yellow colour. The iodide decomposes at ordinary temperatures with considerable rapidity giving sulphur and iodine. At low temperatures however, the solutions are comparatively stable. Sulphur iodide gives a characteristic absorption band in the visible region of the spectrum. The reaction of sulphur iodide (in carbon tetracholride solutions) with aqueous sodium hydroxide is analogous to that of sulphur chloride (in the same solvent) with alkali.

The work will be published shortly.

M. R. ASWATHA NARAYANA RAO.

Department of Chemistry,
Central College,
Bangalore,
August 24, 1937.

Astronomical Society for India.

AN association called the Astronomical Society of India was formed on the 26th July 1910, at Calcutta, but its activities seem to have ceased after September 1915, perhaps on account of the outbreak of the War. During the short period of its existence the Society had done much good work and had published 5 volumes of the monthly Journal containing excellent and instructive articles. The advance made in astronomy and astro-physics since 1915 is tremendous. The revival of the Astronomical Society of India will be of great help to the astronomers in our country both professional and amateur. The Society can be run on the lines of the British Astronomical Association. There are Societies in India for almost all the other branches of Physical Sciences.

The following programme can be adopted by the Society :—

(1) The circulation of current astronomical information.

(2) The encouragement of a popular interest in astronomy.

(3) The arrangement of members in different sections under experienced Directors to study the Sun, Moon and Planets, Comets and Meteors, Variable Stars, etc.

(4) The publication of a Journal once in two months.

(5) The formation of a library and of collections of astronomical instruments and lantern slides for loan to members.

C. K. ANANTHASUBRAHMANYAM.

Kodaikanal Observatory,
July 10, 1937.

REVIEWS.

Collisions of the Second Kind. Their Role in Physics and Chemistry. By E. J. B. Willey. (Edward Arnold & Co., London), 1937. Pp. viii+150. Price 10*s.* 6*d.*

The first suggestion of the probable existence of collisions of the second kind was made by Klein and Rosseland in 1921. Their postulate laid down that in reactions between atoms and electrons, a balancing of collisions of the first kind with those of the second was necessary for thermodynamic equilibrium. Franck extended the principle for reactions between atom and atom and discussed the most probable modes of energy transfer. During the last ten years, the theory has been applied to explain several physical and chemical phenomena. In the monograph under reference, the author has eminently succeeded in presenting a clear and accurate account of the developments, both theoretical and experimental, in a manner that is bound to give profound satisfaction both to the expert in the field and to the investigator in allied branches of research.

The significance of the phenomenon in the excitation of spectra is first considered at some length. An account is then given of the ionization of the noble gases by ions of the alkali metals with special reference to the theories of electron interchange. We next encounter the problem of the emission of electrons under impact of positive ions. More experimental evidence seems to be desirable in the study of such emission and the same remark seems to be applicable to the conclusions relating to cathode sputtering. The pioneer work of Wood on the quenching of resonance radiation and the successful explanations by Franck's theory of the collisions of the second kind, are next dealt with. Of great interest to the physicist in particular is the last chapter on chemical reactions involving collisions of the second kind. A Bibliography containing over 530 references adds greatly to the value of the book.

S. R. R.

Inorganic Preparations. By Alexander King. (Thomas Murby & Co., London), 1936. Pp. 164. Price 5*s.* 6*d.*

As stated in the Preface "this book is a plea for the wider use of inorganic preparations in the teaching of practical chemistry". At present, practical work in inorganic chemistry in many degree courses, consists entirely of quantitative and qualitative analysis, preparations being limited to the organic branch of the science. It is very desirable that there should be greater correlation between theory and practice in the teaching of inorganic chemistry. The present book on inorganic preparations would greatly help in such correlation.

The preparations—187 in all—have been classified broadly according to the type of compound prepared. Due attention has been given to complex salts, to the compounds of the rarer elements and to certain technical reactions. In view of the growing importance of the colloidal state in both theoretical and applied chemistry, the preparation of several inorganic colloids has also been included.

References to original literature are given for practically every preparation, but the reviewer feels that no useful purpose is served by quoting references which are so ancient as to be inaccessible to most of the readers. Under the preparation of potassium permanganate (p. 80) there is a reference to the work of Böttger in 1863, under chlorsulphonic acid (p. 96) to Williamson 1856, under titanium disulphide (p. 127) to the Jahresbericht of 1847. The work of Berzelius in 1826 is given as a reference under molybdenum oxide (p. 129). On p. 44 in dealing with hydrogen persulphide the latest reference given is to the work of Bloch and Höhn in 1908, no mention being made of the improved technique described by Walton and Parsons in 1921.

Attention may be invited to the following errors which have crept into the text. On p. 19 the equation for the effect of heat on potassium permanganate is inaccurate. For drying ferric chloride (p. 47) concentrated nitric acid is suggested for use in the desiccator. On p. 89, line 19, the "distilled nitric

acid" should obviously read "distilled water" and on p. 134 (line 21) "filtrate" is wrongly used in place of residue.

On p. 12 the impression is conveyed that "salting out" of soaps and proteins is identical with the coagulation of hydrophobic sols by electrolytes. No colloid chemist would accept this view. On p. 117, in an attempt at brevity the author states "The mineral (beryl) is fused with alkali to convert the aluminium and beryllium to sulphates". It is hoped that these inaccuracies will be eliminated in the second edition of the book.

On p. 114 in the preparation of sodium thiosulphate the use of hydrogen sulphide may be recommended in order to accelerate the reaction between sulphur and sodium sulphite solution. The reviewer is of opinion that a book on inorganic preparations would gain in value if the common impurities in the more important substances prepared are indicated. A desirable feature from the standpoint of examinations, would be to indicate the properties and uses of the chemicals prepared.

In conclusion it may be stated that the book under review is very suitable as a text-book in practical inorganic chemistry. The printing is good and the price moderate.

B. S. RAO.

A Text-Book of Elementary Quantitative Analysis. By Carl J. Engelder, PH.D., (John Wiley & Sons, Inc. New York and Chapman and Hall, Ltd., London), 1936. Price 13*s.* 6*d.* Pp. 270.

An attempt has been made in this book not only to bring about a close harmony in the teaching of "the theory, the technique and the calculations of qualitative analysis" but correlate as well "the principles and reactions of quantitative analysis with those of qualitative methods". It is laudable that the author has largely succeeded in it. Another interesting welcome change in the present edition of this book is the recognition of the fact that the approach to the study of quantitative analysis lies in beginning with volumetric rather than gravimetric methods which require more precise and difficult technique. On the very grounds it would have been very much to the advantage of the beginner if the author had treated permanganate and iodimetric methods first and reserved the dichromate, precipitation, acidimetric or alkalimetric methods to a later stage. This change has been tried and found to have given really good results.

The theory involved in the methods of quantitative analysis is discussed at length from the modern point of view. But sometimes the explanations offered are somewhat intricate and as such beyond the grasp of a beginner (see page 139, line 3 end of para). Adequate general instructions are given to enable the beginner to master the technique. Different modes of calculating the results from the experimental data are elaborately discussed.

The exercises chosen are elementary and limited in number. The student is asked to complete every volumetric estimation by a minor back titration (see pages 142, 151, etc.). One good feature of the book is that at the end of each chapter a large number of problems based on the calculations dealt with in it, is given to the student to work out.

The author's statement (page 5) that "rise in temperature causes a decrease in ionisation for most electrolytes, water being an exception", had better be replaced by a more precise one, *viz.*, "that the ionisation of strong electrolytes decreases with rise of temperatures and that the ionisation of *weak* acids and *weak* bases *increases* between 0° C. and 40° C. and then decreases rapidly at higher temperatures". It is essential that the beginners should know these details, for most of these quantitative reactions are carried on with all types of electrolytes only between 0° C. and 40° C.

A rational explanation of the mode of calculating the average deviation from the mean of a set of readings should be of considerable value to the student. He will then grasp the point that the mode adopted by the author is an approximation and applicable to small deviations while the formula $\sqrt{\frac{\Sigma v^2}{n}}$, (where $v^2 = x_0^2 + x_1^2 + x_2^2 \ldots\ldots x_n^2$) holds for large ones.

There are, however, very few elementary books on quantitative analysis which discuss the rationale of quantitative reactions and for this reason the publication of this is welcome. It is written with considerable insight into the subject and deserves to be used by beginners.

K. S.

Semi-micro Qualitative Analysis. By Carl J. Engelder, Tobias H. Dunkelberger and William J. Schileer, Ph.D. (John Wiley and Sons, Inc. New York ; Chapman and Hall, Ltd., London), 1936. Price 13*s.* 6*d.* net. Pp. 265.

As the name of the book shows, the method of qualitative analysis advocated by the authors stands between the conventional Macro and the highly refined Micro methods. They have introduced the drop technique into the ordinary macro methods and have evolved out a scheme of analysis based on them.

In respect of the treatment of subject-matter in Part I under the heading "Fundamental principles", this book appears to be exactly like "A Text-Book of Elementary Quantitative Analysis" written by the seniormost of the three authors. The applications of the theory of ionisation and the law of mass action have been treated with considerable clearness. Valence has been treated from the electronic point of view.

The definition of the term "active mass" should be more precise than that given on page 40.

In the systematic detection of the cations and anions, in most cases, ordinary micro methods have been cleverly adapted for submicro detection. The use of the centrifuge has come in handy in this adaptation. The routine method of approach to qualitative analysis has been retained wherever possible. The book is useful not only to the beginner but also to the advanced worker also.

K. S.

Vergleichende Studien Uber Die Morphologie und Histogenese Der Larvalen Haftorgane Bei Den Amphibien. By Ingvald Lieberkind. (C. A. Reitzels Forlag, Copenhagen), 1937. Pp. 1–80, 28 plates and several text-figures.

This very interesting monograph contains a very complete account of the organs of balancing and attachment of the larval stages of *Urodela* and *Anura* amongst the Amphibia. The structure of the balancing organs and the frontal organs of attachment of most of the *Urodela* is discussed in detail and the earlier literature on the morphology, histology, phylogeny and biology of these organs is critically discussed. Amongst the *Anura*, the organs of attachment of the tadpoles of a number of species of the genera *Rana* and *Bufo* are discussed in detail and, as in the case of *Urodela*, the earlier literature on the subject is critically dealt with. In a final chapter the structure of the organs of attachment of the Amphibia is generally discussed and their importance in connection with the phylogenetic questions is brought out. As a result of his detailed studies the author concludes that the organs of attachment in *Urodela* and *Anura* are not, in view of their different development, homologous and that they cannot be compared directly with the organs of attachment of other forms. He is of the opinion that the organs of attachment are of no value in connection with phylogenetic questions and can only be considered as congergent and not homologous structures. This detailed memoir is sure to serve as an authoritative source of reference not only on the structure of the adhesive organs of the Amphibia but also on the histological structure of the Amphibian skin.

B. P.

Skull of *Varanus monitor* (Linn.), By K. N. Bahl, *Records of the Indian Museum*, 1937, 30, Part II. Pp. 133–174.

In a recently issued part of the "Records of the Indian Museum" Dr. K. N. Bahl Professor of Zoology at the University of Lucknow, has published a detailed study of the skull of *Varanus monitor* (Linn.) which forms a very suitable type of the Lacertilian skull for study by students of Zoology in this country. Various accounts of the skulls of different species of the genus *Varanus* have been published from time to time, but none of these accounts are complete or give a sufficiently accurate description of the skull of this lizard. The author, therefore, took up a detailed study of the skull of *Varanus monitor* which is one of the commonest and most extensively distributed species throughout India and parts of Burma. The work involved not only a careful study of the dry skull, but a large number of dissections and preparations had to be made to display the muscles, blood-vessels and nerves, and the author has, therefore, given not only an account of the skull but also of such structures as would make the account complete and easily intelligible. Further, he has compared the skull of this lizard with that of the New Zealand Tuatara (*Sphenodon*) the common European lizard

Lacerta and the spiny-tailed lizard, *Uromastix*.

The paper gives a detailed account of the skull and the constituent bones, as also foramina of the skull, and finally there is a discussion in regard to the streptostylism and metakinetism of the skull, which terms refer respectively to the mobility of the quadrate bone and of the occipital segment in relation to the maxillary segment of the skull. As a result of his study the author has come to the conclusion that the skull of *Varanus* is streptostylic and metakinetic.

The paper is illustrated by 17 beautifully drawn text-figures, which should enable students to study this very interesting type of skull in detail without difficulty.

The publication of such detailed studies on Indian animals is highly desirable and it is hoped that this type of work would be taken up more earnestly by zoologists all over the country.

B. P.

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1. **Théorie du Passage des Rayons Cosmiques a travers la Matière.** By Par J. Solomon, D.Sc. Pp. 57. Price 18 *francs*.

2. **Les Rayons Cosmiques.**—*A Report of the International Conference on Physics.* (Cosmic Radiation), London, 1934. Pp. 34. Price 10 *francs*.

(Actualités Scientifiques et Industrielles, Paris. Hermann and Cie., Éditeurs, 6, Rue de la Sorbonne, 6. 1936.)

The first of these booklets is an able attempt to explain very briefly in terms of the quantum theory the more important cosmic ray phenomena which have been so intensively studied experimentally during the past few years.

The subject-matter is divided into four chapters: 1. Loss of energy at collision, 2. Loss of energy by (production of electromagnetic) radiation, 3. Absorption of very penetrating electro-magnetic radiation, 4. Various processes. In general, the author follows the method of Fermi. The paper is mathematical throughout. Theoretical results are given in the form of curves and many tables.

The booklet ends with a useful, though limited, bibliography listing the more important papers on this subject which were published in 1935 and earlier.

The second of these booklets is a brief report of the papers on cosmic ray phenomena which were read at the International Physics Conference at London and Cambridge in 1934. The list of titles and authors follows:—

Measurement of Absorption of Cosmic Ray Electrons and Photons. By Carl D. Anderson and Seth Neddermeyer.

The Effect of Latitude on Cosmic Rays. By Pierre Auger and Leprince-Ringuet.

Some Measurements of Cosmic Radiation at Great Altitude. By Pierre Auger and Leprince-Ringuet.

Absorption of Cosmic Rays. By P. M. S. Blackett.

A Very High Altitude Survey of the Effect of Latitude upon Cosmic Ray Intensities and an Attempt at a General Interpretation of Cosmic Ray Phenomena. By I. S. Bowen, R. A. Millikan and H. V. Neher.

A Study of Cosmic Ray Bursts at Different Altitudes. By A. H. Compton and R. D. Bennett.

The Connection between Cosmic Radiation and Atomic Disintegration. By G. Hoffmann.

Some Results arising from the Study of Cosmic Rays. By B. Rossi.

Discussion on Cosmic Radiation. By Bernardini, Bethe, Gilbert, Posejpal, Regner and Skobeltzyn.

The above listed papers are published in full in Vol. I of the report of the "International Conference on Physics, London, 1934". Published by The Physical Society, London, and printed by the Cambridge University Press in 1935.

J. M. BENADE.

CENTENARIES

S. R. RANGANATHAN, M.A., L.T., F.L.A.
University Librarian, Madras.

Hutton, Charles (1737–1823)

CHARLES HUTTON, British Mathematician, was born on 14th August 1837 at Newcastle-on-Tyne. His father, who was a labourer, died when Charles was five years old. Through the recommendation of his stepfather, Charles worked as a 'hewer' in a pit. But his love of books soon diverted him from such labour and made him the village schoolmaster of Jesmond in his eighteenth year. After teaching his pupils in the day-time, he himself attended the evening classes in Newcastle and gained proficiency in mathematics. This enabled him to offer instruction in all branches of mathematics in Newcastle in 1770.

His Career

In 1773 the professorship of mathematics at the Royal Academy, Woolwich, became vacant and Hutton secured the place by coming out first in the competitive examination held for the purpose. He held the professorship for thirty-four years till he resigned it in 1807. He spent his retired life at Bedford Row, London, depending chiefly on his pension.

His Publications

Hutton published about ten mathematical books. The sixth book, entitled *Mathematical tables containing common hyperbolic and logistic logarithms* (1785) had an introduction, which is still valued as a learned history of logarithmic work. His most valuable work is the *Mathematical and philosophical dictionary*, which came out in 1795. His *Course of mathematics* was a popular text-book and went through several editions. He contributed several papers to the *Philosophical transactions* of the Royal Society and earned the Copley Medal. Hutton also assisted in drawing up the well-known abridgement of the *Philosophical transactions* in 18 volumes.

His Honours

Hutton was elected a Fellow of the Royal Society in 1774. His estimate of the mean density of the earth, and his report on Maskelyne's observations on which his estimate was based elicited encomium from Laplace. In 1779 Hutton was elected Foreign Secretary of the Royal Society. In the same year, the University of Edinburgh made him an LL.D. On his retirement, the Board of Ordnance complimented him on the success of his work as a professor. Just before his death, he was consulted by the London Bridge Committee with regard to the proper curve which should be adopted in the design of bridges and he gave valuable advice. In 1822 a marble bust of his was presented to the Philosophical Society of Newcastle by his admirers and students.

Hutton died on January 27, 1823.

Harrison, Reginald (1837–1908)

REGINALD HARRISON, a British surgeon, was born at Stafford on 24th August 1837. Son of the Vicar of that place, Harrison prepared himself for the medical profession from the very beginning. He was admitted to M.R.C.S. in 1859 and after being house surgeon in several hospitals, he began private practice at Liverpool in 1864.

His Career

In 1864, Harrison was appointed demonstrator of anatomy at the Royal Infirmary school. In 1865 he was promoted lecturer on descriptive and surgical anatomy and in 1872, lecturer on the principles and practice of surgery. He became F.R.C.S. in 1866 and was on the staff of the Royal Infirmary, Liverpool, till 1889 when he was elected surgeon to St. Peter's Hospital, London, for stone and other urinary diseases. As Hunterian Professor of Surgery and Pathology of 1890–91, he delivered a course of lectures on stone in the bladder. As Bradshaw Lecturer of 1896, he dealt with vesical stone and prostatic disorders.

His Publications

Harrison published four books, three of which dealt with urinary disorders and the fourth was entitled *The use of ambulance in civil practice* (1881). He also contributed several articles to medical periodicals.

His Contributions

Harrison was one of the pioneers of medical education in Liverpool. He was one of the enthusiastic band of workers who gradually lifted the Royal Infirmary school to the status of a University Faculty. Harrison also did much to establish the system of street ambulances which long made Liverpool famous amongst the British towns. He was also the Founder and President of the Metropolitan Street Ambulance Association. His delight was unbounded when his son-in-law, who was Commissioner of the City Police, launched the "White Swan", as the first ambulance car of the city was dubbed.

His Honours

In recognition of his ambulance work, Harrison was made a Knight of Grace of the Order of St. John of Jerusalem. Also, the Khedive of Egypt conferred upon him the First Class of the Imperial Order of Medjideh in appreciation of his services to the School of Medicine at Cairo, which he inspected on behalf of the Royal College of Surgeons, England. He took an active part in reconstructing, with donations of duplicate copies, the medical section of the Toronto Library which was destroyed by fire in 1890.

Harrison died in London on April 28, 1908.

ASTRONOMICAL NOTES.

1. Planets during September 1937.—Venus will continue to be a bright object visible early in the morning before sunrise, its stellar magnitude being $-3{\cdot}4$. On September 24 there will be a close approach to the bright star Regulus (α Leonis), the planet passing within an angular distance of one third of a degree from the star. Mercury will be in conjunction with the sun on September 14; it will attain greatest elongation (18° W.) on September 30 and can be seen as a morning star for a few days about this date. Mars will be moving eastwards in the constellation Scorpio and gradually getting fainter; it will be in quadrature with the Sun on September 14.

Jupiter will resume its eastward motion among the stars about the middle of the month and will continue to be conspicuously visible in the evening sky, crossing the meridian, soon after sunset. Saturn is in the constellation Pisces and in a favourable position for observation, being in opposition to the sun on Setpember 25; its stellar magnitude at the time will be $0{\cdot}7$.

2. Comets.—Information has been received of the discovery on July 4 of a new comet (the sixth to be discovered this year) by Mr. Finsler at Zurich. It was a fairly bright object of about the seventh magnitude at the time of discovery and was situated in the constellation Perseus. The daily motion was towards the north and east, and from the orbits calculated, the date of perihelion passage appears to be about August 12. The comet has been observed to have a small nucleus and a short tail of about a degree in length.

Whipples' comet (1937 *b*) can still be observed with instruments of moderate size. It has been rapidly moving southwards and was in the constellation Corona Borealis at the end of last month. An orbit has been computed by Mr. Kellaway for comet Wilk-Peltier (1937 *c*) from available observations upto May 2. The orbit is elliptical and the date of perihelion passage, 1937 February 21. The period derived is 589 years, but it is still somewhat uncertain.

Far Eastern Rural Hygiene Conference. *

A CONFERENCE on Rural Hygiene for Far Eastern Health Administrations, summoned by the League of Nations Health Organisation, was opened at Bandoeng in Java on August 3rd. This Conference is one of a series that have been, or will be held under the auspices of the Health Organisation in different parts of the world. The first was the European Rural Hygiene Conference in 1931. In 1932 and 1935, African Health Conferences took place. A Rural Hygiene Conference for American countries is also being prepared by the Health Organisation and will be held at Mexico City towards the end of 1938.

The proposal to hold a Rural Hygiene Conference for the Far East was made at the Assembly in 1932 by the representative of India, supported by the Representative of China, and was repeated with further support at the Assembly in 1934. The Bureau of the Health Committee was asked by the latter as early as 1932 to make a preliminary study of the question and obtain the opinion of the Advisory Council of the Eastern Bureau of the Health Organisation in Singapore. The Advisory Council reported in favour of holding the Conference. In view of the interest aroused in the East by the prospect of a Rural Hygiene Conference, the Health Committee decided in October 1935 that it should meet in 1937, and asked its Bureau to undertake the preparatory work.

The holding of this Conference reflects the rising interest in Far Eastern countries and colonies that is being taken in raising the standards of living, both from the point of view of health and nutrition, of the rural population, which comprises the overwhelming majority of the teeming millions of the Far East. The present Conference has been carefully prepared over a considerable period of time.

PREPARATIONS.

A Preparatory Committee consisting of: Mr. A. S. Haynes, formerly Colonial Secretary of the Federated Malay States, Chairman; Professor C. D. de Langen, formerly Dean of the Faculty of Medicine of Batavia; and Dr. E. J. Pampana, of the Health Section of the League of Nations Secretariat, Secretary of the Malaria Commission, made a tour, lasting from April to August 1936, around India, Burma, Siam, Malaya, Indo-China, the Philippines, the Netherlands East Indies and Ceylon.

The Preparatory Committee then prepared a report for discussion at the Conference, in which it endeavors to state on the basis of a mass of facts, observations and experiences, the fundamental terms to which the problem of rural medicine and health can be reduced in the conditions prevailing in the Far East. The different chapters of the report supply a general indication of the matters to be discussed under each item of the agenda of the Conference.

The Conference was attended by delegations from North Borneo, Burma, Ceylon, China, Fiji, Gilbert and Ellice Islands Colony; New Hebrides Condominium, Hongkong, British India and four Indian States, Netherlands East Indies, French Indo-China, Japan, British Malaya, Philippines, Siam, British Solomon Islands Protectorate and Tonga.

HEALTH AND MEDICAL SERVICES.

The first chapter of the report of the Preparatory Committee surveys the different forms of health and Medical services that exist in the Far Eastern territories represented at the Conference. It draws attention to what it calls "the burning question whether, having regard, to the desires of Asiatic Society, one or more than one type of doctor should be trained. In other words, should there be only one body of fully trained medical men or should there also be schools for the rapid and hence incomplete training of students?"

The pros and cons of the practice of training so-called "semi-qualified" or assistant doctors are discussed and the possible alternative of auxiliary medical staff under efficient supervision by doctors trained on European lines is indicated.

"European medical science is everywhere invading Asia, where it encounters what has remained of the old medical lore of Hindu medicine, the Arabian school and the old Chinese institutions, all of them based upon traditional empiricism. The importance of all this should not be underestimated, and official medical science, over-confident of its own infallibility and of the inferiority of this ancient popular medicine, has made the mistake of scorning it. Yet many an old precept can be found which accords with our own views, even though put in a somewhat different form. Thus, frequently we strongly oppose the use of the medicinal herbs and other substances of popular Eastern medicine, forgetting that our own pharmaceutical industry has produced, in addition to sound and valuable medicines, much that it would have been better never to administer to any sufferer.

"The study of these ancient medical cultures and of their remaining vestiges would be of value. They should have a place in the training, so that the young doctor may have at least an elementary knowledge of these questions when he begins practising. Such knowledge is essential if he is to adapt himself to his social environment.

"Lastly, it would be desirable honestly to consider how far these old medical traditions can be reconciled with our own principles, instead of rejecting them in a body as useless and obsolete. This, too, is a subject on which an exchange of views would be desirable: it has incidentally been broached already by a Commission appointed by the League Health Committee, and might with advantage be taken up again." (Pp. 21–22).

RURAL RECONSTRUCTION AND COLLABORATION OF THE POPULATION.

The second chapter of the preparatory report begins by pointing out that "there is no more familiar cry in the newspapers of every Far Eastern country than rural reconstruction. It is also a cardinal point in the policy of Governments and in the activities of voluntary bodies and charitable associations of all kinds. This is

* Issued by the Information Section, League of Nations, August 1937.

particularly the case in India. The recent Royal Commission on Agriculture in that country reported :

> ' If the inertia of centuries is to be overcome, it is essential that all the resources at the disposal of the State should be brought to bear on the problem of rural uplift. What is required is an organised and sustained effort by all those departments whose activities touch the lives and the surroundings of the rural population.'

" Later pronouncements by the Viceroy have declared that this is the policy of the Government. It is clear too, that the policy of the other countries visited by the Commission is actuated by a similar view.

" It is perhaps somewhat strange that this concentration of interest in the rural problem should occur simultaneously in all these countries and that it should be so recent and so comparatively sudden. But it is indisputable that a reorientation of governmental policies is taking place and that the needs of the distant and inarticulate peasant are being weighed in the council chambers where hitherto his voice has been little heard." (Pp. 39–40).

A gradual awakening is occurring among large sections of the rural population in these lands.

"With the perception of the possibility of improved conditions of life is growing the desire to attain them. The progress of education is having its effect. Interest is being shown in the improvement of health, in economic problems and in all matters which affect the maintenance of a reasonable standard of living. The dullness of village life is being dissipated by the dawn of rural reconstruction. No longer does all the peasantry live, as in the words of the Malay proverb ' like a frog under a cocoanut shell, in a tiny world of its own ' " (p. 44).

In this connection, the importance of education and of the spread of the co-operative movement is stressed, and methods by which health authorities enlist the interest and support of the peasants are described.

SANITATION AND SANITARY ENGINEERING.

Chapter 3 of the report covers the subject of sanitation and sanitary engineering. The Preparatory Committee begins this chapter by pointing out that "modern hygienic habits are often difficult to inculcate in the East because of customs of long standing. Thus, peasants may be driven by compulsion to construct latrines, to make openings in their dwellings, or to protect their wells ; but unless they can be convinced that these measures are useful, or at any rate shown evidences that they have been adopted with satisfactory results by their neighbours, the latrines they have constructed will frequently remain unused, the openings will be blocked up, and, despite the fact that a hygienic well is available, water will continue to be drawn from the river. Consequently, statistics of sanitary improvements should be interpreted cautiously. The work of persuasion, which postulates for its success close contact with the population, can advantageously be left to health centres." (Pp. 49–50.)

Housing, drinking water supply, latrines, manure and household refuse, and fly control are all discussed in this chapter.

NUTRITION.

" Investigations into the state of health of the peoples of the East, no matter what their starting-point, lead back invariably to the question of nutrition. Dietetics is a branch of science which has a variety of aspects in Asia ; there, even more than elsewhere, dietetic research required the close co-operation of chemists, physicists, agronomists, physicians, veterinary surgeons and economists. It is therefore to be hoped that this necessary contact will be established as a result of the Conference.

" The prevailing opinion is that the state of nutrition of the populations of rural districts is not wholly satisfactory in any of the Asiatic countries. It is thought that, of the 1,150,000,000 inhabitants of that continent, not less than 75% have a diet below the standards fixed by European science. From various publications, and from the information that the Committee collected during its tour, it appears that a large part of the population is living on the border-line of the minimum requirements, while millions are even below that level.

" These statements should, however, be accepted with some caution, because an examination of the studies so far made in Asia shows that few accurate statistics are available.

" Whereas in other continents there has been on occasions over-production of food at different times and places, so that production has been restricted and food even destroyed, this has never occurred in Asia. Everything produced is always quickly consumed, and, so far from there being a limitation of crops, the dominant question everywhere is how to increase them. An exception may be made as regards a few articles intended for the world market, such as sugar and copra.

" The food problem in the East is almost exclusively a rural problem, since more than 90% of the population live outside the towns." (Pp. 55–56).

This chapter reviews such subjects as the composition of the diet of the rural populations ; the chemical composition and biological value of the different food-stuffs ; different diseases of alimentary origin ; and the proportion of the family budget spent on food.

The final remarks of this chapter are to the effect that " a well-fed and healthy population is vital to every country for its development and future. But, in all Asiatic countries, only relatively trifling sums are allocated to the detailed study of national nutrition or to attempts to improve it.

" In some places, the authorities think this is a field that should rather be left to private initiative. The public authorities still fail to appreciate the great importance of food problems. Only in the event of a war or economic depression do they decide to act.

" The growth of the population and the ensuing increased importance of adequate nutrition will certainly help to wean most Governments from this short-sighted policy. The assertion often made by the authorities that very primitive peoples show an unfailing intuition in regard to their food supply in time of need, is obviously exaggerated, and indeed, is contradicted by practical experience. A small measure of intuition there certainly is, but it can easily be overrated.

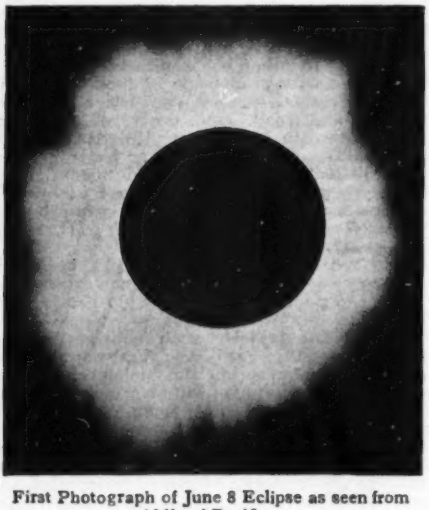
"If the Conference helps to bring about a change in the views of some of the Governments, that will in itself be an appreciable advance." (Pp. 73–74.)

The final chapter reviews the chief diseases affecting the rural population of Far Eastern countries and the measures for combating them. These diseases are: malaria, plague, ankylostomiasis, tuberculosis, pneumonia, yaws, described as "the rural disease *par excellence*" leprosy.

One of the chief results expected from the Conference is the improved contacts that will be established between the Health Administrations of different countries and colonies and even of different provinces in, for instance, India. At present, Health Administrations frequently work at similar or identical problems without the advantage of knowledge of each other's activities and their results.

The National Geographic Society—U. S. Navy Eclipse Expedition of June 8.*

HUGE streamers of the sun's corona, reaching out as much as 5,000,000 miles from the sun, and great flamelike tongues of super-heated hydrogen gas extending 30,000 to 50,000 miles above the sun's surface were among the phenomena seen and photographed during the sun's eclipse of June 8 by the National Geographic Society—U.S. Navy Eclipse Expedition which observed it from Canton Island in the mid-Pacific.



First Photograph of June 8 Eclipse as seen from middle of Pacific.

The expedition's observations of the eclipse are reported to be highly successful, although the complete scientific results will not be known until after months of study of the hundreds of photographs, spectrographic records and other data that were obtained during the three and one half minutes of darkness.

As in previous eclipses the astronomers again found evidence of the presence of "coronium", a mysterious element in the sum's corona. Coronium is believed by many astrnomers to be some element already known, but existing in the sun's corona in a chemical state not familiar to scientists on earth. The expedition has not yet had time to determine whether its records show existence of any elements on the sun not previously known.

Using a process new in eclipse work, the expedition successfully measured the percentage of the light of the sun's corona that is polarized. These records are expected to prove valuable in study of the composition of the corona, which at present is a scientific puzzle.

Corona Streamers Crisscrossed.

The shape of the corona was nearly circular, which is usually the case when the number of sunspots is approaching a maximum, as at present. Photographs show that the streamers of the corona are crisscrossed in many directions, perhaps because the surface of the sun is now extremely turbulent. The total amount of light from the corona was measured and found to be about one-half that of the full moon.

A painting of the eclipse was made by Charles Bittinger, Washington artist. He noted the colours and general appearance of the eclipse during totality and is now adding the finishing touches to the picture.

Dr. Gardner, with the aid of an apparatus which equalized the amount of light reaching the plates from different parts of the corona, photographed both long streamers of the corona and the prominences, or hydrogen flames extending up from the sun's surface, on the same plate with good definition. He also photographed the eclipse on colour separation plates, which record the red, yellow and blue ranges of colour separately. These pictures were made with special plates which carried their own filters, thus eliminating the loss of definition which usually arises when filters are used with lenses of extremely long focal length. Later, these can be combined in such a way as to give an accurate colour photograph of the eclipse, with the aid of the colour values as depicted in Mr. Bittinger's painting.

Useful Time Data Gathered.

Mr. Willis and Captain Hellweg checked the times at which the eclipse began and ended and found that the Naval Observatory had predicted these within a few seconds of their actual occurrence. This check on eclipse timing will be extremely useful to the Observatory in its calculations of the movements of the sun, moon and earth, which are used in determining accurate time for everyday use.

Many photographs were obtained of the total eclipse with various lengths of exposure, and with several colour filters, showing the corona and prominences in good detail, and motion pictures of the entire eclipse were taken.

Tests of radio reception during the eclipse indicated that apparently there was less fading of signals during the time that the sun was darkened by the moon than during daylight.

* From the *Geographic News Bulletin* No. 3106, by the Courtesy of the National Geographic Society.

RESEARCH ITEMS.

The Gordian Unwinding of Knots.—H. Wendt (Die Gordische Auflösung von Knoten", *Math. Zeit.*, Bd. 42, 680–699) has investigated the *überschneidung*-number (*i.e.*, cross-over number) of knots and has also obtained the connection between it and the cyclic overlying manifolds (*zyklische überlayerungen*) of the knots (*i.e.*, the outer space of the knots). He has also given examples of knots to show that this number may, in certain circumstances, be greater than the genera (*i.e.*, *geschlecht*) and *vice versa* in some circumstances.

A knot is a one-one-continuous transform of a circle in three dimensional space. In order to simplify matters the three-dimensional euclidean space in which the knot is placed is closed so that it is conceived of as a hyper 3-sphere S_3 in an euclidean E_4. Two knots are said to be equivalent if the space containing one of the knots can be topologically (one-one-continuous) transformed into the other so that the two knots correspond to each other. In order to simplify matters still further it is supposed that every knot can be made equivalent to a knot which consists of a finite number of straight line bits. On account of this supposition and as every one-dimensional cycle is homolog zero in S_3, we can have a surface without singularities with the knot as boundary. The most fundamental and yet unsolved problem in the theory of knots is the determination of the complete system of topological invariants of the open complex $S_3 - k$ (where k is the knot). A number of these are known. For some there are methods for calculating them and for some others there are no methods of calculating them at all although we easily see that they are invariants. Some of the important among them are these :—(1) *Genera* : Now among the surfaces in S_3 which have k as the boundary there are those which when they are canonically represented as a sphere-surface with one-one-corresponding holes with k as boundary, the number of such holes is the least equal to h. This is called the genera of the knot. (2) The minimum number of double points of a projection of the knot on a plane. (3) When we weave surfaces in S_3 with k as boundary, the surfaces penetrates itself and the least number of such penetrations is the Panmwitz-Invariant. There is no method as yet of calculating this for knots. (4) In order to convert a knot into a circle by means of homotop deformations it is necessary in general to cross itself. The minimum number of such crossings is called the *überschneidungs*-zahl. It is obviously zero in the case of the circle and one in the case of *kneeblatt-schlinge* (*i.e.*, the knot in the ordinary use).

Wendt concerns himself with this number (for brevity we use v for this number). For obtaining his result he connects this with the cyclic overlying manifolds of the knot (which can all be calculated—see, *e.g.*, Seifert-Thelfall *Lehrbuch der topologie*, ch. 8). He conceives the overlying manifolds as having been generated by attaching the requisite number of $S_3 - k$'s along a surface woven into the knot just as we usually consider a Riemann surface. Considering the homologie groups of one dimension just before and after a crossing he obtains the following results :—

(1) If $v = 1$, then the one-dimensional homologie group of the g-leaved overlying manifold (which is branched along k obviously) is generated by means of $(g - 1)$-elements.

(2) A knot cannot be unwound with n-crossings when the least number of the generators of the homologie group of the g-leaved overlying manifolds is greater than $n(g - 1)$.

Now taking the sum of n *kneeblatt-schlinges*, he shows that it can only be unwound with $(n + 1)$ crossings. In this case $(n + 1)$ is also the genera of the knot.

He has also given examples of knots where v is $>$ their genera. (The reverse case happens in the case of knots 8_{20} and $9I_{42}$ in the Alexander-Brigg table as pointed out by him, *i.e.*, $v = 1$, and genera is 2^{10}.) He gives interesting constructions of knots with v being double their genera.

K. V. I.

On the Asymptotic Values of an Integral Function.—Grunsky (*Math. Zeit.*, Bd. 42, 674–679) has given an interesting and short proof of the theorem that the asymptotic values of an integral function of order ρ is at most equal to 2ρ. This conjecture of Denjoy was proved in part by Carlmann with 5ρ instead of 2ρ and Ahlfors was the first to give a proof by deepening the methods of Carlmann. Another short proof was given by McIntyre two years ago. Grunsky has first shown easily that if k be *any* region of area I and $\omega(z)$ any function analytic in it, (it may be equal to different functions in different parts of k) and I′ is the area of the Riemann's surface of ω corresponding to k. Then

$$\text{II}' \geqslant \text{A}^2, \text{where A}, = \frac{1}{2i}\int \text{R}\,\overline{\omega}\; d\,\text{I}.$$

where R is the boundary of k. Then following almost the usual order of the earlier proofs he obtains the following sharpening of the Denjoy-conjecture.—

(1) If $f(z)$ $[z = re^{i\theta}]$ is an integral function with k different asymptotic values so is

$$\underline{\lim}\ \frac{\text{Log M}(r)}{r^{k/2}} > 0.$$

(2) If on the asymptotic paths with $Z \to \infty$

$$\overline{\text{Lim}}\ \frac{|\theta|}{\text{Log } r} = \lambda > 0, \text{ then}$$

$$\overline{\text{Lim}}\ \frac{\text{Log Log M}(r)}{\text{Log } r} \geqslant k/2\,[1+\lambda^2] \text{ with}$$

the same result for the lower limit with the corresponding assumption.

K. V. I.

Determination of the Electronic Charge by the Oil Drop Method.—The determination of X-ray wave-lengths by the grating method showed

that the value of the charge on the electron should be higher than the value obtained by Millikan. Millikan's value, recomputed by Birge, was $4 \cdot 768 \times 10^{-10}$ e.s.u. while Bäcklin and Bearden gave 4·805 and 4·806 respectively on the basis of their X-ray measurements. Recently attempts have been made by Kellström, Bond and others to attribute the discrepancy between these values to the inaccuracy of the value of the viscosity of air employed by Millikan. The viscosity of air was found to be higher than that used by Millikan, so that Millikan's data together with the new values of the viscosity gave a value for e very near to the X-ray value. Great interest attaches to the value of e since Eddington's theory of protons and electrons requires that e should be 4·806. Now Y. Ishida, I. Fukushima and T. Suetsugu (*Sc. Papers, Inst. Phys. & Chem. Research, Tokyo*, 1937, **32**, 57) have repeated Millikan's experiment with various refinements and using the value of the viscosity of air obtained by Harrington (*viz.*, $\eta_{23} = 0 \cdot 00018226$ whereas Kellström's value is 0·00018348), they find $e = (4 \cdot 806 \pm 0 \cdot 003) \times 10^{-10}$ e.s.u.

The condenser plates of stainless steel, 22 cm. in diameter and 2·5 cm. thickness, were placed nearly in the middle of the tank, the lower plate being supported by three glass tubes, 2 cm. in diameter and 5 cm. in length, and having polished supporting ends. This was done to reduce the effect of convection currents on the speed of the oil drops. To prevent the evaporation and oxidation (or adsorption) of the oil drops occurring when commercial oils are used, a special oil was carefully prepared from animal oil. To get rid of the heating effect of the arc, a circulating water cell of 70 cm. length was used in addition to the "ultrazin" filter. To correct for the shape of the oil drops, observations were made only on spherical drops and on spheroidal drops which later on became spherical. The temperature of the bath was kept constant to within a few thousandths of a degree. The condenser plates, separated by quartz prisms of $14 \cdot 1674 \pm 0 \cdot 0001$ cm. thickness, were charged by a highly insulated lead storage battery of 10000 volts and two ampere-hour capacity. The voltage varied by 2 volts in 5 hours. The time was measured by a Société Genevoise printing chronograph, controlled by the Riefler master clock which did not vary more than $\frac{1}{100}$ sec. per day. The final value obtained was, as stated before, $(4 \cdot 806 \pm 0 \cdot 003) \times 10^{-10}$ e.s.u.

The Neutrino Theory of Light.—Jordan's neutrino theory of light has already been summarised in these columns. Fock raised some objections to the theory both of a physical and mathematical nature. The mathematical objections have been refuted by Nagendra Nath and others and now Fock accepts the validity of these replies (*Comptes Rendus, Acad. Sciences*, URSS, 1937, **15**, 241), but reaffirms that the physical objection raised by him is still valid. His objection is that the quantum number distinguishing between neutrinos and antineutrinos plays an essential part in the theory, while such a distinction is not physically possible since the neutrinos and antineutrinos have both zero charge and the same mass and spin. Louis de Broglie also considers that Jordan's theory of pairs of unconnected neutrinos giving rise to optical phenomena which are only apparently attributable to quanta, cannot be upheld (*Annales de la Société Scientifiques de Bruxelles*, 1937, **57**, 99). He prefers his own theory which considers a quantum as a real entity formed from two particles obeying Dirac's equation. His objections to Jordan's theory are as follows:—

(1) The theory of Jordan has found admirers because it succeeds in deducing Bose statistics for quanta from the Fermi statistics obeyed by the neutrinos. But to have one mechanism for deriving the Bose statistics for composite particles like the α-particles from the Fermi statistics valid for the component elementary particles, and to have an entirely different mechanism for quanta, is not, in his opinion, a very satisfactory procedure.

(2) If one assumes that a swarm of neutrinos, all of the same energy $h\nu_m$, passes through a screen having a resonance frequency ν lying between $\frac{\nu_m}{2}$ and ν_m, the effect to be expected according to Jordan's theory is contrary to experiment. For, the swarm of neutrinos of energy $h\nu_m$ gives rise by their Raman effect to the appearance of a continuous radiation having frequencies lying between 0 and ν_m. After passing through the screen however they have energies equal to $h\nu_m - h\nu$ and thus correspond to a continuous radiation of frequency lying between 0 and $\nu_m - \nu$ (which is $< \nu/2$). Thus the passage through the screen should according to Jordan's theory lead to a cutting off of the radiation beyond $\nu_m - \nu$, whereas what is actually observed is only an absorption line at ν.

(3) The diffraction effects observed with quanta of frequency ν correspond to an actual frequency ν and it is difficult to see why neutrinos having no such single frequency should give rise to such effects.

(4) The law of rectilinear propagation of light has been verified up to astronomical distances. It is difficult to see why pairs of neutrinos which do not form a composite particle should be simultaneously emitted so accurately in one direction.

The objections raised by Fock and de Broglie provide much material for careful consideration.

Diabetic Ketosis.—Prof. Szent-Györgi's latest discovery arising from his studies of tissue metabolism, concerns the use of succinic acid as a remedy for Ketosis of diabetes (*Lancet*, 1937, **233**, 200). Only five patients have so far been treated but in one of them it was found that as little as 1.0 gm. daily by mouth would remove ketosis, the acetone bodies disappearing completely from the urine and the alkali reserve rising. According to Szent-Györgi the respiration of tissues is catalysed by certain C_4-dicarboxylic acids, of which succinic acid is one. Pyruvic acid in particular, which is an intermediary substance in carbohydrate metabolism is catalysed by these C_4-acids. If for some reason the catalysis fails, pyruvic acid is not oxidised but is instead converted into acetone bodies. He suggests that

" ketosis of diabetes is due to failure of the C_4-acids to catalyse the oxidation of pyruvic acid, this failure probably being due to shortage of C_4-dicarboxylic acids in diabetes, either because their formation is inhibited or because their destruction is accelerated."

Sugarcane-Bamboo Hybrids.—Remarkable results have been obtained by Rao Bahadur T. S. Venkatraman, in his work on the intergeneric hybridization between sugarcane and bamboo—*Bambusa arundinacea* (*Ind. Jour. Agri. Sci.*, 1937, 7, 513). " Success in sugarcane breeding depends largely on the extent of variation which it is possible to induce in the seedlings raised ; and it was felt that the bringing in of other *genera* (other than *Sorghum Durra* Stapf.) might increase the range of such variation and perhaps also open out new lines of advance." The first attempt to effect a cross between sugarcane and bamboo which on a previous occasion was given up, was renewed in December 1936.

" On the sugarcane side the parents employed were the two Java canes, POJ 213 and POJ 2725 : these were the only varieties available for crossing at the time, December being practically the end of the cane flowering season at Coimbatore. Both these canes have little fertile pollen of their own but set seed profusely when cross-pollinated with other cane varieties. POJ 2725 was the cane which was first used in the intergeneric hybridization with sorghum. The bamboo pollen employed was that of *Bambusa arundinacea* Willd. from Madras, the few available inflorescences being railed co Coimbatore in special receptacles. The attempt has yielded twenty-nine hybrids—eighteen with POJ 213 and eleven with POJ 2725, as mother parent."

" Though even from the very early stages these hybrids displayed characters not previously noticed in sugarcane seedlings during almost a quarter century of sugarcane hybridization at Coimbatore, this announcement was delayed till the plants showed definite and clear bamboo characters. These have since been found in the mode of underground branching, nature of shoot and bud formation, central cavity in the stem, anatomical characters of the stem and root and number of chromosomes."

" It is well known that sugarcane seedlings display considerable variations among themselves in the F_1 generation. The present batch of twenty-nine hybrids show similar variations and different bamboo characters are showing themselves in different plants. They further show abnormalities even more numerous than those met with in the intergeneric cross with sorghum."

A View of Magmatic Differentiation.—C. N. Fenner in a paper at the Tercentenary Conference of Arts and Sciences at the Harvard University (*Journ. Geol.*, **45**, No. 2) has pointed out certain difficulties in the way of the theory of differentiation by crystal fractionation. He doubts whether the results of the laboratory experiments can be applied to silicate melts at great depths. His observations at many places have shown successive outpourings of rhyolite and basalt, without any intermediate members. From this and from the undoubted examples in Alaska where acid rhyolites have assimilated very basic rocks in contravention to the well-known principle of Bowen, he believes that crystal fractionation cannot be accepted universally to explain the diversity in igneous rocks.

The Water Content of Magmas.—In the evolution of the different igneous rocks some petrologists have attributed a large influence to the water-content of the magmas, whereas others have assigned a very minor part to it. This is partly due to the fact that the actual percentage of water in different magmatic bodies is not definitely known, and in most cases it is estimated to be not more than about two per cent. James Gilluly (*Am. Jour. Sci.*, **33**, No. 198) basing his arguments on the assumption that the hydrosphere is the result of original differentiation of basalt, inclines to give a much higher percentage of water-content to magmas. Most of the analyses of the igneous rocks do not show the actual water-content, but represent only the minimum quantity. Working on Daly's assumption of the density stratification of the Earth, Gilluly has estimated that there is as much as four per cent. of water in basalts and eight per cent. in granites.

The Urinogenital System of the Male Indian Elephant.—T. L. Schulte (*Amer. Journ. Anat.*, May 1937, **61**, 1) has described the kidneys and testis of *Elephas indicus* along with their ducts. The kidney is not divisible into cortical and medullary regions in the adult. They have no papillæ but two to four shallow depressions, each at the apex of the pyramid receiving the collecting tubules emptying into each minor calyx. There is no renal plexus, the tubes which form a major calyx joining the ureter. The testes are abdominal and permanently fixed. Their secretion which was creamy white had nonmotile sperms and its specific gravity was the same as that of urine. It had an alkaline reaction.

SCIENCE NOTES.

Length Regularity and Percentage of Short Fibres in Cotton.—Sometime ago a new Stapling Apparatus was designed at the Indian Central Cotton Committee Technological Laboratory with which it is possible to determine the mean length and the fibre-weight per inch (which measures the fineness of staple) of a cotton accurately and quickly. A full account of this apparatus was published in the *Journal of the Textile Institute*, Manchester. The apparatus is now used in several mofussil stations in India. This apparatus did not yield information regarding the proportion of fibres of different lengths present in a sample of cotton. In certain operations a knowledge of this feature of cotton is important both to the practical spinner and the research worker. In order to overcome this limitation a new attachment has been designed by Messrs. Ahmad and Nanjundayya — the designers of the Stapling Apparatus — which can be fitted to the Stapling Apparatus and by means of which it is possible to determine the proportion of fibres of different lengths in a sample of cotton. It is also possible with this device to determine quickly the percentage of fibres shorter than a prescribed limit present in a sample. Both these determinations can be carried out quickly and smoothly and tests at the Laboratory have shown that the attachment gives consistent results which agrees well with other standard methods. A full account of it will be published in due course.

* * *

Quality of Indian Cotton.—An important press communique issued recently by the Central Cotton Committee deals with the question of quality of Indian Cottons. Three charges are frequently levelled against Indian cotton; it is said that owing to the tendency on the part of exporters to mix staples and varieties, the Indian cotton cannot be obtained with its pure and natural qualities. It is also reported that shipments of Indian cotton are not uniform and even-running. The third complaint often made is about the so-called false packing.

The actual position is totally different. The introduction by the Government, of the Cotton Transport Act of 1923, and the Cotton Ginning and Pressing Factories Act of 1925, which made breaches of the regulation punishable under Law, has checked all malpractices, such as watering the cotton or mixing with inferior qualities. The result is that to-day, India can hold its own in the world's market as regards purity and quality.

India occupies a prominent place among countries producing cotton of various staples and standards of cleanliess from 1 $\frac{1}{32}$" staple to very nearly the shortest staple produced anywhere. One of the best instances is the growth of Punjab-American Cotton in Punjab and Sind. These provinces produce long staple 289 F cotton, with a staple length of 1 $\frac{1}{32}$", 4 F cotton with a staple length of $\frac{7}{8}$" and *Deshi* Cotton with a length of $\frac{3}{4}$".

As regards shipments, the uniformity of shipment depends upon the shipper. There are firms in Bombay enjoying excellent reputation for decades for uniform shipments. With regard to the third charge of false packing, they are few and negligible. In fact the question of false packing is more in evidence in some of the varieties of cotton imported into India, particularly cotton from America.

Sir Purushotamdas Thakurdas, in the course of an article on the "Real situation in India" published in the International Edition of *Cotton Trade Journal*, 1937, says "with the extension of cultivation of staple varieties in India, especially in the Sukkur Barrage area in Sind, the possibility of India's supplying long-staple clean cotton, will increase from year to year. Already there are signs that the supply of such cotton exceeds the demand so that India will soon be in a position to meet, to some extent, the requirements of the world for cotton of a staple length of about 15/16" to 1".

"Various parts of the world also require fair and short staple cotton and supplies of this are not likely to decrease, as with, steady prices for cotton, the acreage under cotton in India need not diminish. In fact, India holds a predominant position in the world as an exporter of short and fair staple cotton to the tune of 2,000,000 to 2,500,000 bales, and, given fair trade and reasonable prices, she is capable of retaining it for many years to come."

* * *

Indian Central Cotton Committee.—The 33rd Half-yearly Meeting of the Committee was held in Bombay on the 9th and 10th August, Mr. N. C. Mehta, the acting Vice-Chairman of the Imperial Council of Agricultural Research, presiding. In the course of his presidential address, Mr. Mehta made three important suggestions, namely, the reorganisation of Statistical Service, a systematic survey of the marketing organisation of Cotton from the raw product to the finished cloth and an effective organisation with the assistance of trade associations for enhancing the consumption of Indian cotton in India and abroad. The collection through members of the Committee visiting Europe and other countries, of specific information desired, was also suggested by the President.

The Committee had on its agenda as many as 87 subjects, the more important of them being, progress reports of the botanical, mycological, entomological, physiological, cotton survey, seed distribution, technological and propaganda schemes. A new research scheme for cotton jassid investigation in Sind was also considered. The Progress Report of the Director, Technological Laboratory, Matunga, showed the completion of several investigations carried out at the laboratory, *viz.*, the effect of twist in the length and strength of cotton fibre, the effect of weather on the fibre properties, and spinning quality of standard Indian cotton and on the deterioration of Broach cotton caused by bacteria and fungi and identification of the latter.

The Committee has taken the initiative to fulfil the long-felt need of the Industry of starting a testing house which will be housed at its laboratory in the first instance, where tests on samples of cotton, yarn and cloth will be carried out under standard conditions on payment of certain fees. The Committee has sanctioned

Rs. 6,000 for the purchase of necessary equipment, and certain tests of chemical character will be carried out at the Department of Chemical Technology of the University of Bombay.

The Committee considered suggestions relating to the revision of standard yield figures of cotton in the Bombay Presidency and Sind and decided to request Prof. Mahalnobis and Dr. Fisher to give further guidance on the subject.

* * *

Industrial Research Bureau.—The two Bulletins issued by the Indian Industrial Research Bureau on the "Manufacture of Photographic Plates in India" and on "Improved Reflex-copying" by Mr. N. Kasinathan place before the public a record of Research work of great practical Importance undertaken in the Physics Laboratories of the Presidency College, Madras. The first of these theses gives a lucid account of the difficulties of the pioneer in the field, and of the choice of materials and the processes involved in the highly technical and advanced branch of the manufacture of photographic plates. The second Bulletin details a simple and satisfactory method for reflex-copying of still objects and drawings. These publications will, no doubt, stimulate interest in the subject and be of immense help to those who are engaged in the development of photograph industry in India.

C. S. V.

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Indian Chemical Society.—An ordinary meeting of the Society was held on Friday, the 23rd July, at the University College of Science, Calcutta, Prof. J. N. Mukherjee presiding.

The Chairman referred to the loss sustained by the Society through the death of Prof. Panna Lal of Science College, Patna. A condolence resolution was passed, the Fellows standing.

The Chairman presented the Sir P. C. Ray 70th Birthday Commemoration Medal to Dr. P. B. SARKAR, who was considered to be the best candidate by the Board of Examiners appointed by the Council.

The following were admitted as Fellows:—(1) Mr. Charles H. Shirtcliff (*Ishapore*), (2) Dr. Tarapada Banerjee (*Dacca*). (3) Mr. B. B. Chaudhury (*Poona*), (4) Prof. Andre Girardet (*Lausanne*), (5) Dr. S. V. Anantakrishnan (*Calcutta*) and (6) Mr. M. G. Kale (*Bombay*).

Dr. P. B. Sarkar delivered a lecture on "The present state of our knowledge of lignin".

* * *

The Madras Library Association.—We have before us the interesting Ninth Annual Report of the Madras Library Association for the period from the 1st February 1936 to the 31st January 1937. Although the number of ordinary members has decreased, there seems to be considerable progress in the Library Movement. Mrs. Sresty paid a sum of Rs. 3,000 to improve the finances of the library Saraswata Niketanam, Vetapalem, and also gave a donation of three acres of wet land worth about Rs. 2,000. Mr. S. Chattanatha Karayalar, M.A., B.L., M.L.A., made a generous gift of Rs. 5,000 to the Public Library Society of Tinnevelly. The Summer School of Library Service continued to be conducted by the University of Madras, and eighteen persons obtained the University Certificate in Librarianship. Forty-five public meetings were held during the year. The Council has inaugurated a praiseworthy scheme of fostering in the school children the habit of reading.

Hunderd popular lectures on various topics were delivered during the last 5 years and some of the lectures are available for free distribution.

In 1936, 119 libraries furnished library returns.

The travelling library at Mannargudi founded by the late Rao Sahib S. V. Kanakasabai Pillai in 1931 is doing very useful work in this area. The West Tanjore District Board has started rural library work and is running a library van. Rural libraries have been started in other localities also.

The Hospital Library Service in the City of Madras is doing very useful work. Similar services have been established at Madura, Cuddalore and Pudukottah.

Chirstmas vacation lectures on school libraries were held by the Librarian, Madras University Library, in the year under report.

The Association has published till now 5 books which will be of immense use to librarians.

It is gratifying to note that the Government of Madras has made a provision of Rs. 10,000 in the budget estimate for 1936-37 for non-panchayat libraries.

There are 26 Annexures to the report which contain much useful information.

K. A.

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The National Geographic Society—Smithsonian Institution Wild Animal Collecting Expedition.—As has already been announced (*Curr. Sci.*, 1927, **5**, 460), Dr. Mann, the leader of the Expedition and his assistants aided by local scientists and animal collectors, have been scouring the tropical islands of the Netherlands East Indies, for strange and rare wild animals, birds and reptiles, many of which have never so far been exhibited in the United States. These creatures are being collected for the National Zoological Park, Washington. Among the menagerie of strange creatures, which the Expedition has collected so far, are several Maleos, birds half as large as chickens but which lay eggs with ten times the volume of hens' eggs (about 2½ times the diameter). The huge eggs are covered by mounds of earth and vegetable debris and left to hatch. When the young Maleos emerge they are all ready to fly and take care of themselves. The Expedition has also collected three kangaroos, wild pigs, a pair of pygmy buffaloes, a dozen beautiful birds of paradise of four different species, many monkeys and several pythons, huge snakes which squeeze their prey to death, cassowaries, large ostrich-like birds; several specimens of the cuscus, an animal with a prehensile tail like a 'possum'; parrots; lizards; snakes; and pigeons.

The Expedition plans to collect more animals on the west coast of Sumatra, and in Siam before returning home.

* * *

Mr. M. W. Sayer, I.A.S., Imperial Agriculturist and Joint Director, Imperial Agricultural Research Institute, New Delhi, is granted leave on average pay for four months and twenty-eight days combined with leave on half average pay for 10 days with effect from the 28th May 1937.

From the same date:—(1) **Dr. H. S. Pruthi**, Imperial Entomologist, is appointed to officiate as Joint Director, Imperial Agricultural Research Institute, New Delhi, in addition to his own duties.

* * *

Sugarcane Research Station, Shahjahanpur.—Rai Bahadur R. L. Sethi, Economic Botanist to Government of U.P., having been deputed with the Government of India as Assistant Agricultural Expert to the Imperial Council of Agricultural Research, the Government of U.P. have approved temporarily the appointment of Dr. R. N. Mathur, M.Sc., Ph.D., Sugarcane Physiologist, to the post.

* * *

Royal Institute of Science.—Dr. Mata Prasad delivered the inaugural address of the Central College Chemical Society, Bangalore, on the 30th June.

Dr. G. V. Jadhav, who was on leave in England, returned to resume his duties in the Chemistry Department, after taking the Ph.D. degree of the Manchester University. He has also been elected an Associate of the Institute of Chemistry.

Mr. S. S. Dharmatti, M.Sc., a research student has been elected an Associate Member of the Institute of Physics.

* * *

Indian Science Congress Association.—The following scientists have recently accepted the invitation to come to India for the Jubilee Session:—Prof. G. Barger, F.R.S., Professor of Chemistry, University of Edinburgh; Sir Lewis Fermor, F.R.S., Late Director, Geological Survey of India; Prof. J. Hendrick, Professor of Agriculture, University of Aberdeen; Dr. L. D. Stamp, Reader in Economic Geography, University of London; Dr. A. E. H. Tutton, F.R.S., Past President, Mineralogical Society; Prof. N. Bohr, Professor of Physics, Institute for Theoretical Physics, Copenhagen; Prof. J. C. Jung, Professor of Psychology, University of Zurich.

* * *

Stereoscopic Mapping with Multiplex Projector.—A 25 square mile tract can be "picked up" from an airplane and set down on a table top in three dimensions by means of an instrument known as a multiplex projector now being built by Bausch & Lomb Optical Co., for the U.S. Army Air Corps.

"The device makes the user feel precisely as though he were a superbeing standing over the earth and able to caress the tops of mountains and run his hand along the bottoms of great gorges. So perfect is the reproduction that a giant smoke stack looks realistic enough to prick a finger even at 25,000 times reduction.

"The method involves no actual model making with tools. A complete representation of a countryside can be obtained in a field station within a few hours after the exploring plane takes off.

"Hitherto made only abroad, this costly precision device is now being built in the laboratories of Bausch & Lomb to meet War Department requirements and for general map-making purposes. Aside from its value in preparing for military operations in unfamiliar terrain, it is said to be the most convenient and rapid means for accurate map-making available.

"By simple measurement with a scale in the reduced model one can measure the height of a hummock or the slope of a road as easily as one can measure the height of an inkstand on a desk.

"A plane working in conjunction with the aero-projector begins operations over an area containing three points accurately surveyed by traditional methods. As it flies out into unmapped territory, the shutter of an automatic camera looking down clicks at regular intervals.

"The film is then developed and printed on small glass plates which are used as lantern slides in a battery of projectors mounted above a table. The images formed by adjacent projectors on the table overlap just as do the areas covered in successive photographs. Alternate projectors form their images in red and green light. The user wearing spectacles with one lens red and the other green, sees the overlapped area stereoscopically. He gets the same impression of depth as though he were a giant so huge that his eyes were set apart by the distance the plane flew between successive pictures.

"The scene does not look natural, however, until the orientations and positions of the battery of projectors reproduce exactly the relative orientations and positions of the taking camera.

"A number of operators can work simultaneously drawing relief maps under one battery of projectors. The whole system of images appears a meaningless jumble of red and green light and shadow to a person not wearing the colour spectacles."

* * *

Edwards Vacuum Pipe Line Installations.—We have recently received from Messrs. Edwards & Company a copy of their latest leaflet, giving details regarding installation, upkeep performance, etc., of the vacuum pipe line. In the use of vaccum processes in chemical, biological and physical work the water ejectors systems are the only ones generally considered, and as the many advantages of the electrically operated vacuum line are not widely appreciated the pamphlet seeks to give a comparative idea of the chief characteristics of the two systems.

The general scheme of the vacuum line installation is a central pump unit serving a pipe line to which can be fixed a number of vacuum cocks. In chemical and physical laboratories and works, where distillations, filtrations, drying, impregnations and analytical operations are done on a bigger than individual scale, this system will have a special appeal. There is little doubt that this system will supersede in the near future the water pumps.

* * *

Announcements.

Woodhouse Memorial Prize.—In memory of Mr. E. J. Woodhouse, late Economic Botanist and Principal of Sabour Agricultural College, who was killed in action in France in 1917, a biennial prize in the form of a Silver Medal and Books of a combined value of Rs. 100 will be awarded to the writer of the best essay on a subject to be selected from the list noted below

The length of the essay should not exceed 4,000 words:

1. Hybrid vigour in plants and its significance in plant breeding and agriculture.
2. Agricultural problems of the Indian Sugar Industry and their solution.
3. The importance of purity and quality of seeds of farm crops and how to prevent their deterioration.

The competition is open to graduates of Indian Universities and to Diploma holders and Licentiates of recognized Agricultural Colleges in India who are not more than 30 years of age on the date of submission of their essays.

Papers should be forwarded to the Director of Agriculture, Bihar, Patna, before the 30th November 1937.

Failing papers of sufficient merit no award will be made. Essays must be typewritten on one side of paper only.

* * *

The **Maharaja of Kalahandi** having very kindly invited a party of botanists to make a survey of the flora of his State, an expedition composed of not more than 15 members will be conducted under the auspices of the Indian Botanical Society from December 15th to December 25th. Further details can be obtained from Prof. P. Parija, Ravenshaw College, Cuttack (Orissa), who will lead the expedition.

* * *

Indian Science Congress Association.—In addition to the discussions announced in our last issue, the following have been arranged:

Section of Zoology.—The place of systematics and morphology in the study of the living animal.

Sections of Medical Research, Veterinary Research and Physiology.—Animals and their diseases in relation to man.

* * *

We acknowledge with thanks, receipt of the following:—

"Agricultural Gazette of New South Wales," Vol. 48, No. 9.
"Journal of Agricultural Research," Vol. 54, Nos. 8-11.
"Monthly Bulletin of Agricultural Science and Practice," Vol. 28, No. 7.
"Journal of Agriculture and Live-Stock in India," Vol. 7, Part 4.
"The Philippine Agriculturist," Vol. 26, No. 2.
"Allahabad Farmer," Vol. 11, Nos. 3-4.
"Journal of the Royal Society of Arts," Nos. 4413-4417.
"Biochemical Journal," Vol. 31, No. 5.
"Biological Reviews," Vol. 12, No. 3.
"Journal of the Indian Botanical Society," Vol. 16, No. 4.
"Chemical Age," Vol. 36, Nos. 938-940; Vol. 37, Nos. 941-42.
"Journal of Chemical Physics," Vol. 5, No. 7.
"Journal of the Indian Chemical Society," Vol. 14, No. 5.
"Berichte der Deutschen Gesselschaft," Vol. 70, Nos. 7 and 4.
"Experiment Station Record," (U.S.A.). Vol. 76, No. 6; Vol. 77, No. 1.
"Transactions of the Faraday Society," Vol. 33, No. 195.
"Indian Forester," Vol. 63, Nos. 7-8.
"Forschungen und Fortschritte," Vol. 13, Nos. 18-13.
"Genetics," Vol. 22, No. 4.
"Journal of the Geological, Mining and Metallurgical Society of India," Vol. 8, Nos. 3-4.
"Indian Trade Journal," Vol. 125, Nos. 1620-24.
"Quarterly Bulletin of Health Organisation, (League of Nations)," Vol. 6, No. 2.
"Medico-Surgical Suggestions," Vol. 6, No. 7.
"The Calcutta Medical Journal," Vol. 32, No. 7.
"Review of Applied Mycology," Vol. 16, No. 7.
"Nature," Vol. 139, Nos. 3529-30; Vol. 140, Nos. 3531-33.
"Journal of Nutrition," Vol. 13, No. 6; Vol. 14, No. 1.
"Indian Journal of Physics," Vol. 11, No. 3.
"Research and Progress," Vol. 3, No. 4.
"Canadian Journal of Research," Vol. 15, No. 6.
"Journal of Research (National Bureau of Standards)," Vol. 18, No. 4.
"Science and Culture," Vol. 3, No. 1.
"Sky," Vol. 1, Nos. 8-9.
"Lingnan Science Journal," Vol. 16, No. 2.
"Science Progress," Vol. 32, No. 125.
"Indian Journal of Veterinery Science and Animal Husbandry," Vol. 7, Part 2.

ACADEMIES AND SOCIETIES.

The Indian Academy of Sciences:

July 1937. SECTION A.—S. L. MALURKAR: *On a Method of Solving Linear Differential Equations in Series.* S. Z. AHMAD AND R. D. DESAI: *Heterocyclic Compounds. Part III—The synthesis of Cyclopenteno* (1′ : 2′ : 2 : 3).—*Chromones and a Discussion of the Mechanism of the Pechmann and the Simons Reactions.* K. NEELAKANTAN AND T. R. SESHADRI: *Constitution of Gossypitrin. An Attempt to Define the Position of the Glucose Residue.*—The methylation with diazomethane was not complete. K. SUBBA RAO AND B. SANJIVA RAO: *Studies in Adsorption on Gels. II—.A Comparative Study of the Capillary Spaces in Gels of Silica and Alumina.*—A micro-spring balance of quartz fibre is used. It is found that the capillaries in chalky gels are wider than those in glassy gels. K. S. GURURAJA DOSS: *Inhibition of Fluorescence.*—Inhibition by ions such as Cl′, Br′, I′ can be interpreted on the basis of collisions of the second kind. N. VENKATANARASIMHACHAR AND K. S. GURURAJA DOSS: *Selective Adsorption on Silica Gel from Pyridine-Alcohol Mixtures.*—An adsorption compound $C_5H_5N \cdot 2EtOH$ is formed at the interface. K. SUBBARAMIAH AND B. SANJIVA RAO: *Physico-Chemical Investi-*

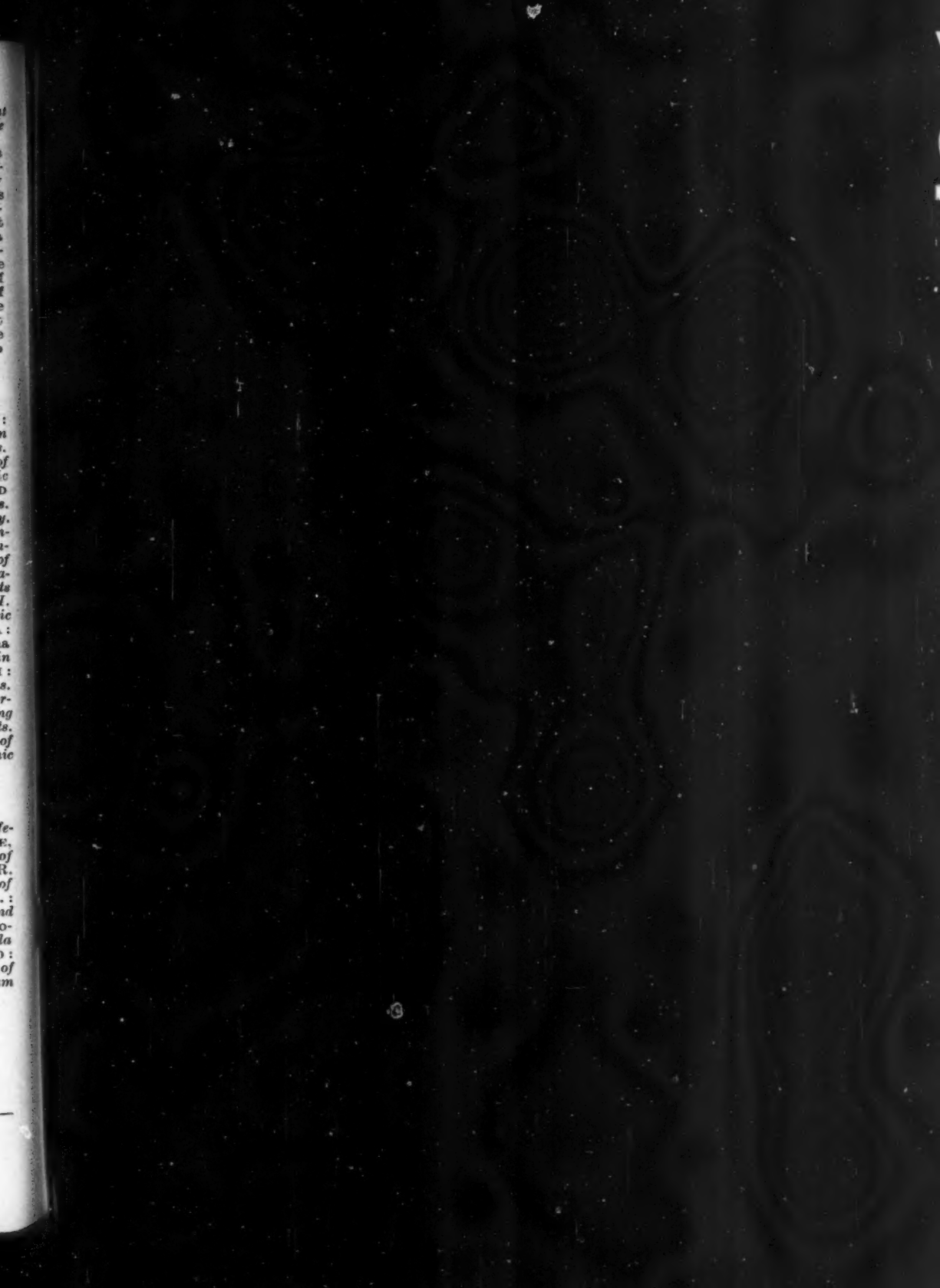
gations on Varietal Differences in Rice.—I. Sorption and Desorption of Water Vapour by Rice Grains.—The capillaries in superior varieties of rice are broader than those in inferior kinds. Storage of paddy seems to cause a widening of these capillaries. *II. The Protective Action of Suspensions of Rice in Water.*—There is no correlation between the varietal differences and the gold numbers or congo rubin numbers of rice suspensions. *III. Electrical Conductivities of Rice Suspensions in Water.*—The differences observed are not characteristic of quality. The observed increase is not due to any hydrolysis but to the dissolution of free electrolytes already present in rice. K. SUBBARAMIAH AND B. SANJIVA RAO: *The Mechanism of the Clarification of Muddy Water by* Strychnos potatorum *Seeds.*—The albumin and other colloids present in the seeds sensitise the suspension and coagulation is then caused by the alkaloid ions. The paste, if used in excess, fails to clarify water. A. A. KRISHNASWAMY AYYANGAR: *Correlation by the Method of Factors.* D. R. BHAWALKAR: *An Explanation of the Maximum in Secondary Electron Emission from Metals.*—The maximum is explained on the assumption that the rate of loss of energy of the primary electron obeys the Thomson-Whiddington Law and the secondary electrons generated at various depths are absorbed by the target on their way out. S. CHOWLA: *Auluck's Generalisation of the Simson Line Property.* F. C. AULUCK AND S. CHOWLA: *The Representation of a Large Number as a Sum of "Almost Equal" Squares.* M. R. SIDDIQI: *On the Theory of Non-linear Integral Equations.* B. K. SINGH AND B. MISRA: *The Physical Identity of Enantiomers—Part IV. The Raman Spectra of* Dextro *and* Lævo *Camphoric Acids and Camphoric Anhydrides.*—The two spectra are identical. I. CHOWLA: *A New Evaluation of the Number* Γ (k) *in Waring's Problem.*

July 1937. SECTION B.—M. K. SUBRAMANIAM AND R. GOPALA AIYAR: *The Golgi Apparatus and the Vacuome in Protozoa—Some Misconceptions and the Question of Terminology (A Review).*—From a critical reading of the available literature, it appears that what is described in many cases as Golgi apparatus in protozoa, excepting probably the sporozoa, does not answer to the definition of the Golgi apparatus; further critical studies, bearing in mind that some of the Golgi elements may become modified as the contractile vacuole, parabasal or stigma in some species may offer a new approach to the study of the Golgi apparatus in protozoa. MANECK B. PITHAWALLA: *Climatic Conditions in Sind.*—The paper is a continuation of the Geographical Analysis of the Lower Indus Basin (Sind), already published in the *Proceedings* (1936, 4 B, 283–355). It is illustrated with necessary graphs, sketch maps, etc. G. W. CHIPLONKER: *Echinoid from the Bagh Beds.*—With the extensive collection at the disposal of the author it has been possible to carry out a detailed study of the echinoids. Besides the eight species previously known to be represented in these beds, six new and important forms are now added to the list, thus giving a basis much more definite than was possible hitherto, for the correlation of these beds with those outside India. From a comprehensive study of the vertical distribution and affinity relations of the echinoids from the Bagh Beds with those from Europe, North Africa and Western Asia, it is shown that some of the species show close affinities with eo-Cretacious forms and appear to be ancestral to some meso-Cretacious species.

Indian Chemical Society:

May 1937. J. C. GHOSH AND B. C. KAR: *Oxidation of Sulphydryl Bodies by Hydrogen Peroxide in presence of Inorganic Catalysts. Part II. Oxidation of Cystine by means of Hydrogen Peroxide in presence of Vanadic Acid Sol.* SHRIDHAR SARVOTTAM JOSHI AND GAJENDRA SINGH: *Thermoageing of Colloids. Part II. Variation of Viscosity and Opacity.* NRIPENDRA NATH CHATTERJEE: *Spiro-compounds. Part IV. Formation of Spiro-compounds from* Cyclo*-pentanone. Synthesis of* cyclo*Pentane-spiro-*cyclo*pentane and its Derivatives.* S. K. RANGANATHAN: *Experiments towards the Synthesis of* iso*Fenchone. Part I. A Synthesis of* e*-Dimethylpentane-*e*-tricarboxylic Acid.* S. V. PUNTAMBEKAR AND S. KRISHNA: *The Oil from the Seeds of* Ximenia Americana *Linn. A New Unsaturated Fatty Acid, Ximenin Acid.* S. K. CHAKRAVARTI AND P. B. GANGULI: *A Note on Raman Scattering of Silicate Solutions.* M. V. SITHARAMAN AND S. RANGACHARI: *Peroxidases. Part IV. A Method of Estimating Peroxidase Activity from E. M. F. Measurements.* B. C. KAR: *Oxidation of Phenols by means of Hydrogen Peroxide in Presence of Inorganic Catalysts.*

Indian Botanical Society:

August 1937.—SRINIVASA IYENGAR, G.: *Life-history of* Santalum album *Linn.* BOSE, PRAPHULLA KUMAR: *Cytological Studies of* Argemone mexicana *Linn.* GORRIE, R. MACLAGAN: *The Economic Importance of Changes in Plant Cover.* NARAYANA RAO, L.: *A Note on the Variations in leaf-form and Ascidium Formation in* Tabernæmontana coronaria *R. Br.* Kundu, B. C.: *A new Nitella from Rajshahi, Bengal.* TANAKA, TYOZABURO: *Further Revision of Rutaceæ-auratioidæ of India and Ceylon. (Revisio Aurantiacearum VIII).*

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